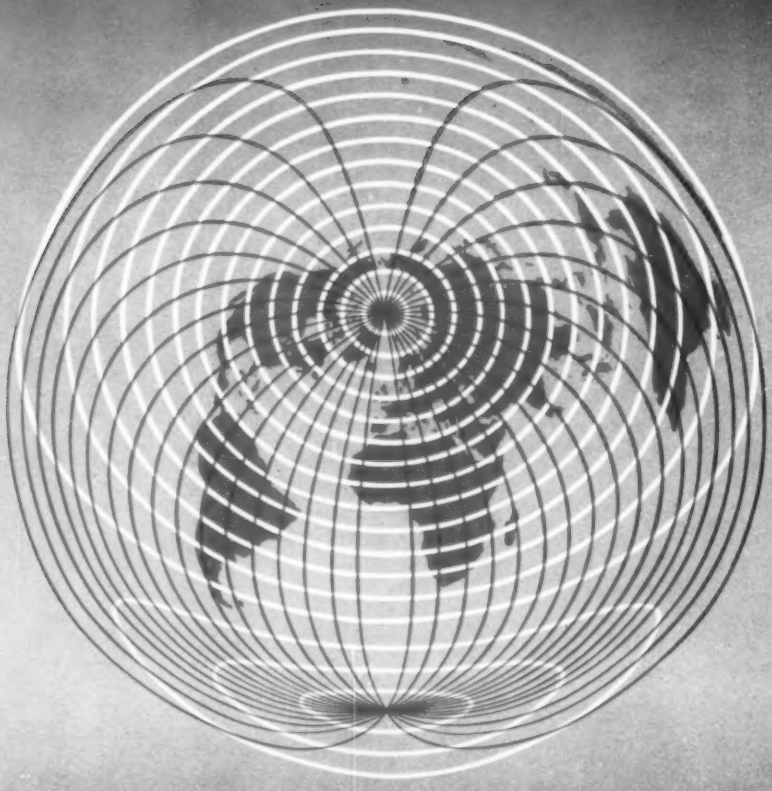
Wireless World

MAY 1951 · TWO SHILLINGS



RADIO, TELEVISION AND ELECTRONICS

The VITAL LINK

For the tough job of connecting the T/V Camera to the control van something extra in the way of a trailing cable system is needed. This is well provided for in BICC T/V Camera Cables with moulded-on Polypole Couplers.

Take the 22-core cable for instance : by the use of single wire conductors the diameter is reduced to only ·850 in.—two-thirds the size of its conventional stranded wire equivalent ! And the Polypole Coupler, integrally moulded to the cable end, reduces the possibility of conductor breakage to a minimum.

Truly a perfect combination built for the job—and it bears the BICC hallmark of dependability.

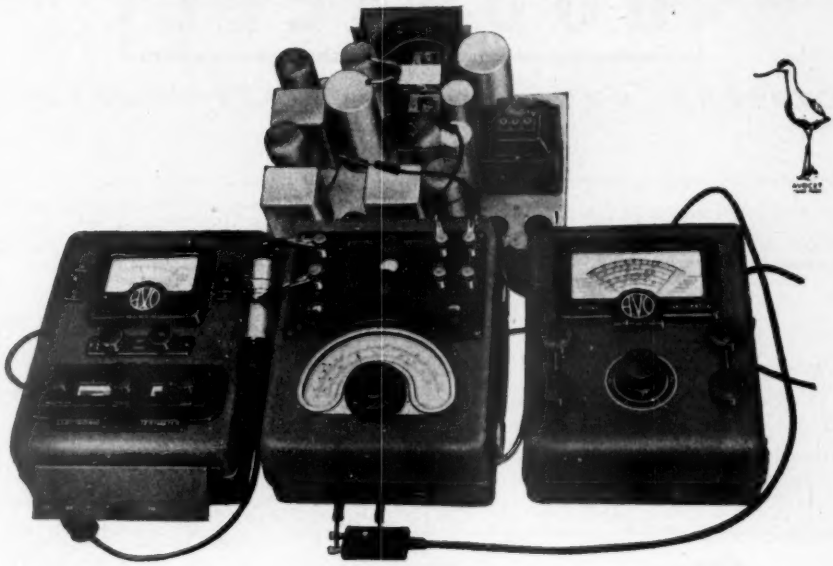
Our technical staff will be pleased to discuss this new development with you.

B.I. Callender's

T/V CAMERA CABLES AND COUPLERS

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

The PERFECT TEST TEAM



The illustration depicts a set of modern "AVO" testgear being used to measure the "Q" of the secondary winding of the second I.F. transformer on a chassis of unknown characteristics—just one of many tests which can be performed by this combination of instruments.

A signal of predetermined frequency from the "AVO" Wide Range Signal Generator is being fed into the Electronic Test Unit, where it is amplified and fed to the secondary winding of the transformer. The Electronic Testmeter is connected across the tuned circuit under test and, from the readings obtained and the controls of the Electronic Test Unit, the "Q" of the circuit can be determined.

The three instruments, shown as a team, cover a very wide field in measurement and form between them a complete set of laboratory testgear, ruggedly constructed to withstand hard usage.

ELECTRONIC TESTMETER

A 56-range instrument combining the sensitivity of a delicate galvanometer with the robustness and ease of handling of an ordinary multi-range meter. Consists basically of a highly stable D.C. Valve Millivoltmeter, free from mains variations and presenting negligible load on circuit under test.

Switched to measure :—

D.C. Volts : 2.5mV to 10,000V.
D.C. Current : .25μA to 1 Amp.
A.C. Volts : .1V to 2,500V R.M.S. up to 2 Mc/s.
.1V to 250V R.M.S. up to 200 Mc/s.
A.C. Power Output : 5mW to 5 Watts.
Decibels : —10db to + 20db. Zero level 50 mW.
Capacitance : .001μF to 50μF.
Resistance : .2ohm to 10 Megohms
Operates on 100-130v. and 200-260v. 50-60 c/s. A.C. mains.

ELECTRONIC TEST UNIT

For measuring small values of A.C. voltage, inductance, capacity, and "Q" at radio frequencies. Although designed primarily for use with "AVO" instruments, it can be used with any suitable Signal Generator/Valve Voltmeter combination.

As a Wide Range Amplifier, it is capable of an amplification factor of 40 ±2—3db between 30c/s and 20Mc/s

As a Capacity Meter, it covers measurements at radio frequency from .5pF to 1000pF. in two distinctly calibrated ranges

As an Inductance Meter it gives direct measurements from .5μH. to 50mH. in six ranges.

As a "Q" Meter, it indicates R.F. coil and condenser losses at frequencies up to 20 Mc/s.

Operates on 100-130v. and 200-260v. 50-60 c/s A.C. mains.

WIDE RANGE SIGNAL GENERATOR

An instrument of wide range and accuracy for use with modern radio and television circuits.

Turret coil switching provides six frequency ranges covering 50 Kc/s. to 80 Mc/s.

Range 1. 50 Kc/s.—150 Kc/s.
" 2. 150 Kc/s.—500 Kc/s.
" 3. 500 Kc/s.—1.5 Mc/s.
" 4. 1.5 Mc/s.—5.5 Mc/s.
" 5. 5.5 Mc/s.—20 Mc/s.
" 6. 120 Mc/s.—80 Mc/s.

Accuracy to within 1% of scale marking. Gives sensibly constant signal of good wave-form, modulated or unmodulated, over entire range. Minimum signal less than 1μV at 20 Mc/s. and less than 3μV between 20 and 80 Mc/s. Gives calibrated output from 1μV to 50mV.

Operates on 100-130v. and 200-260v., 50-60 c/s, A.C. Mains. Battery-operated model also available.

Sole Proprietors & Manufacturers :—

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD.

WINDER HOUSE · DOUGLAS STREET · LONDON S.W.1 Telephone: VICtoria 3404-9

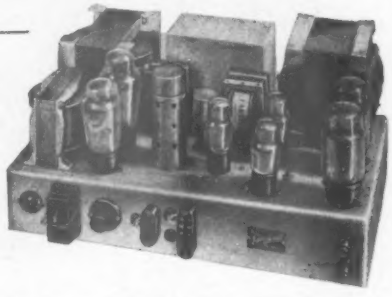
GOODSELL

RECEIVERS AND HIGH-FIDELITY AMPLIFIERS

NOTE THESE FEATURES

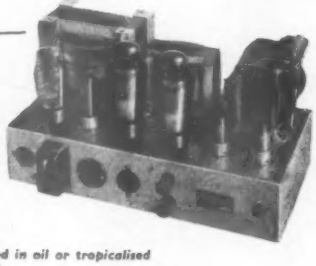
★ Impregnated grid coupling condensers.
★ Paper condensers on the H.T. supply line.
★ Matched or close tolerance resistors, where balance is important.
★ Cadmium-plated steel chassis.
★ Partridge Mains and Output Transformers.
★ Model D.P.S. with separate H.T. supply incorporated on the same chassis for use with multi-stage pre-amplifiers.

Williamson Amplifier Type K.T.66 D.P.S. to specification. Illustrated is the dual power supply model with Partridge transformers, large paper condensers and B.V.A. valves.
Price **£29/5/-**.



● **Four-Stage Tone-Control.** Wide range four-stage tone-control and equaliser for L.P. and Standard records, with microphone and radio input.
Complete with engraved perspex panel **£7/17/6.**
Four-Station pre-set superheterodyne receiver with variable selectivity, from **£8/15/-** *(Tax £1/18/11)*

Type E.L.37 D.P.S., illustrated, is a new model, using a special output transformer with sectionalised windings and having an extremely low leakage inductance, together with the latest Mullard B8a valves. 9 watts output **£18/18/0**



Amplifiers using transformers and chokes hermetically sealed in oil or tropicalised are available for export or special orders

You need a GOODSELL for good reproduction

GOODSELL LTD., 40 GARDNER ST., BRIGHTON, SUSSEX. Phone: BRIGHTON 26735

LONDON REPRESENTATIVE :

HOLLEYS RADIO, 285 CAMBERWELL ROAD, LONDON, S.E.25. Phone: RODney 4988

FOR HIRE PURCHASE TERMS AVAILABLE, WRITE TO L.R.S., BALCOMBE, SUSSEX

..with a wide range of industrial applications

The Mullard range of electronic flash tubes is finding increasing use in industrial photography and in problems involving the analysis of motion in production processes.

On account of their high luminous efficiency, low-triggering voltage, daylight colour quality, and short-flash duration, the Mullard flash tubes at present available offer wide possibilities in equipments used for applications varying from the motion-study of workers to the examination of high-speed machinery in operation.

Brief technical details on these tubes are listed below. Fuller information will be supplied on request to the Communications and Industrial Valve Department.

TYPE	DESCRIPTION	MAXIMUM SINGLE DISCHARGE RATING (JOULES)	MAXIMUM OPERATING VOLTAGE (KV)
LSD2	Microsecond flash tube	36	10
LSD3	For operation in portable flash equipments	100	2.7
LSD3A			
LSD6	For studio flash equipments. Provision is made for a modelling lamp. This tube supersedes the LSD4	1000	2.7
LSD7	For higher power portable equipments	200	2.7
LSD8	Stroboscopic flash tube	30 watts dissipation	2.7
LSD9	Quartz tube for high-power or U.V. flash	1000	2.7

A full range of straight tubes is also available for those who require line source flash tubes.

Mullard

MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE LONDON, W.C.2

MVT 100

TELEVISION & RADAR

SQUARE WAVES

THIS OSCILLOSCOPE HAS A STEPPED Y-AMPLIFIER GAIN CONTROL COMPENSATED, ON EACH STEP OF APPROXIMATELY 6 DB., TO ENSURE ACCURATE REPRODUCTION OF SQUARE WAVES

OTHER FEATURES

BUILT-IN WOBBULATOR
TIME-BASE 10-250,000 c/s
BRILLIANCE MODULATION
SHIFT CONTROLS, etc., etc.

PRICE **£25** MODEL 11W

WRITE FOR DETAILS

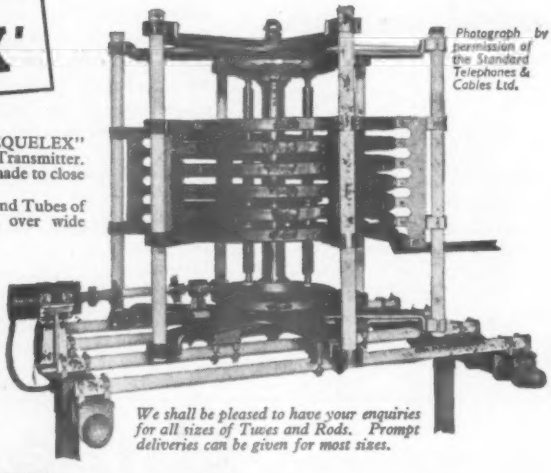
HIRE PURCHASE TERMS AVAILABLE

ERSKINE LABORATORIES LTD., SCALBY, SCARBOROUGH, YORKS.

(THE DEVELOPERS and MANUFACTURERS OF THE NOW FAMOUS TYPE 13 FOR THE SERVICES)

FOR HIGH-FREQUENCY INSULATION

specify **'FREQUELEX'**



Photograph by permission of the Standard Telephones & Cables Ltd.

The Tuning Coil shown is supported by our "FREQUELEX" Ceramic Rods, and forms part of a 200 K.W. Radio Transmitter. This is only one of many applications where Rods made to close limits are required.

We specialise in the manufacture of Ceramic Rods and Tubes of various sections in several classes of materials over wide dimensional ranges.

The Principal Materials are :—

1. **Porcelain for general insulation.**
2. **Frequelex for High Frequency insulation.**
3. **Permalex and Templex for Capacitors.**

The degree of accuracy depends on the size of the Rod or Tube, but the standard degree of accuracy is outlined in the Inter Service Component Manufacturer's Council—Panel R Specification embodied in our Catalogue of Radio Frequency Ceramics, copy of which will be sent on request.

Large Rods up to 44" long and 1¼" square are used as supports for Tuning Coils, etc.

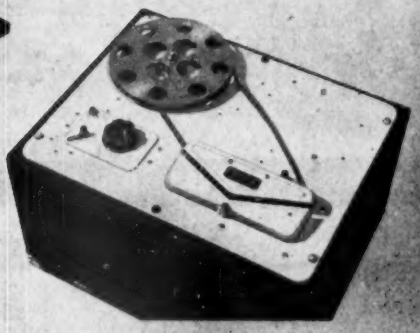
We shall be pleased to have your enquiries for all sizes of Tubes and Rods. Prompt deliveries can be given for most sizes.

Bullers LOW LOSS CERAMICS

BULLERS LIMITED, 6 Laurence Pountney Hill, E.C.4. Phone: MANsion House 9971 (3 lines) Grams: Bullers, Cannon, London

BL48

The Ferrograph, combining operational simplicity with fidelity, is universally acknowledged an outstanding magnetic tape recorder of British design and manufacture. Among its users are numbered educational establishments, broadcasting studios, scientific and research organisations as well as a host of discerning music-lovers to whom quality recording and reproduction are first essentials.



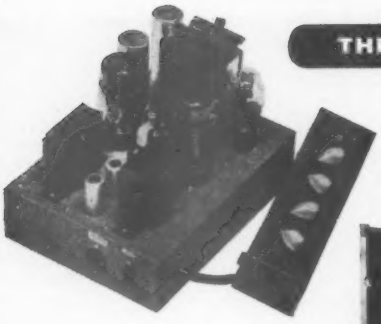
Ferrograph, Series "L"—Utilising a modified Wearite "Tape-Deck," the Ferrograph Model L.67 provides a continuous-playing loop giving up to 4 minutes at 7½" per second or 8 minutes at 3¾" per second with top responses of 10,000 cycles and 5,000 cycles respectively. It has been introduced to meet the needs of such applications as announcements, rehearsals, background music and effects or indeed, any position where the requirement is continuous repetition or repetition at stated intervals.

Ferrograph, Series "Y"—Recorder/reproducers providing the twin advantages of portability and rack-mounting. Designed primarily for "Services" use, Model "Y" recorder is housed in a robust aluminium case, has an amplifier meeting the exacting requirements of Government specifications and has been supplied to a number of broadcasting authorities in locations of severe climatic conditions. Model "Y" (not offered for general sale), provides *inter alia* the facilities of two side-by-side tracks, three tape speeds, viz. 7½", 3¾" and 1⅞" per second, 600 ohm inputs and outputs, remote control and voice/signal operation.

Ferrograph

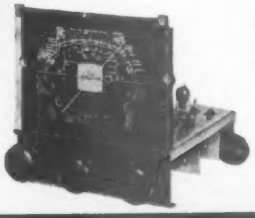
British Ferrograph Recorders are designed and manufactured by *Wright & Weaire Ltd.*

LONDON AND SOUTH SHIELDS



THE NEW KS1 HIGH-FIDELITY AMPLIFIER

This amplifier incorporates features of advanced design. The output stage is Triode connected KT66 valves in P.P. with negative feedback. The controls include Mic/Radio/Gram78/L.P. Separate bass and treble controls. Output 6 watts for 20 mV input, distortion below 0.5% response linear 30.—20,000 cps. **£17 . 17 . 0**



RC TUNING UNIT

Highly sensitive 4 valve, 3 waveband unit, combined TRF/Superhet reception, delayed AVC, infinate impedance detector, two R.F. stages on T.R.F. Guaranteed TWO years. **£14 . 18 . 6**

including Purchase Tax

TRICORNE SPEAKER CHAMBER

For optimum acoustic performance with any good 12 inch speaker. Labyrinth construction, walnut veneered and cross-braced. **£11 . 11 . 0**

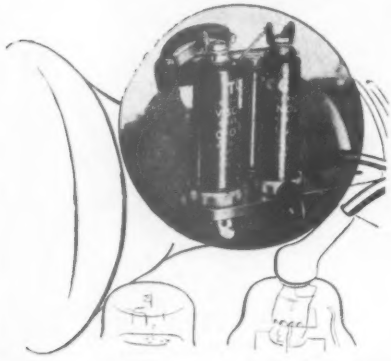
Plus 20/- deposit (returnable) for crate.

Write to-day for fully illustrated catalogue, to:

Charles AMPLIFIERS (SALES) LTD

Phone: WESTern 3350

CHARLES AMPLIFIERS *(SALES)* **LTD.,** 181 KENSINGTON HIGH ST., LONDON, W.8



BOOST YOUR EXISTING E.H.T. SUPPLY

You have a television receiver that is now not so new. No doubt you would like to substitute a modern tube and obtain a brighter and improved picture. Of course, you want to retain the existing E.H.T. supply, but it is insufficient for the higher anode voltage required. A problem with an easy solution. A Flyback E.H.T. Booster, which can be incorporated in your receiver, either commercial or home constructed, without disturbing or overstressing the existing E.H.T. components. Easily and cheaply constructed, the only components required are one 2MΩ 1 watt resistor, two 0.001 mFd 6kV capacitors and a 36 E.H.T. miniature high voltage rectifier.

For further details of the Flyback E.H.T. Booster and also methods of obtaining E.H.T. supply using

WESTINGHOUSE **WESTALITE**

36 E.H.T. MINIATURE HIGH VOLTAGE RECTIFIERS

send 6d. in stamps for a copy of "The All Metal Way" (which also includes details of H.T., L.T. and H.F. rectifiers) to Dept. W.W.5.

WESTINGHOUSE BRAKE & SIGNAL CO. LTD., 82 York Way, King's Cross, London, N.1

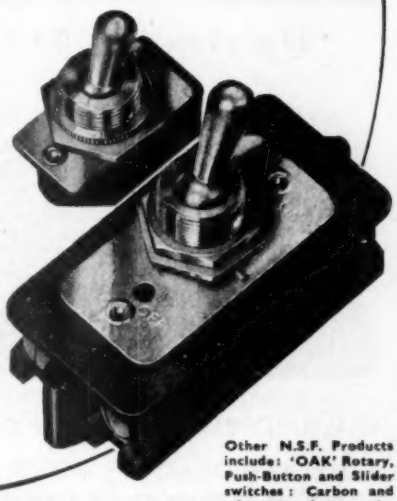
INSPECTION

-makes good soldiers -and good switches!

Men and machines are not, as yet, infallible — output that is 100% perfect is only a factory manager's dream. Until that Utopian vision can become a reality, we must continue to safeguard our reputation — and yours — by a most rigorous standard of inspection at every production stage from raw materials to finished product.

Only by so doing can we be assured that every Cutler-Hammer switch you buy from us will worthily uphold the reputation that has been so laboriously built up over many years. Only by so doing can we look forward to retaining your goodwill. Only by so doing can we increase still further the already long list of appliance manufacturers standardising on Cutler-Hammer Switches.

Let us know your problems: we are specialists in switchcraft.



"THE SWITCH PEOPLE"

NSF CUTLER-HAMMER APPLIANCE SWITCHES C-H

Certain types of Cutler-Hammer switches have been granted limited Type Approval by R.C.S.C. to R.C.S/151.

Other N.S.F. Products include: 'OAK' Rotary, Push-Button and Slider switches: Carbon and wire-wound potentiometers for Television and Radio applications

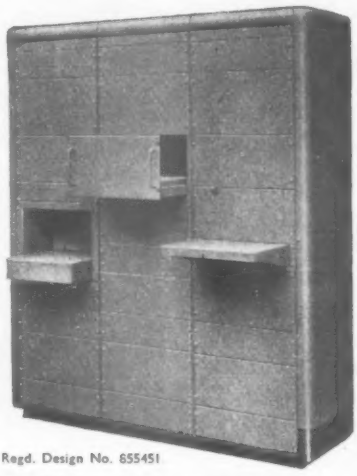
N.S.F. LIMITED · KEIGHLEY · YORKS

Phone: Keighley 4221/5. Grams: ENESEF Keighley. **LONDON OFFICE: 9 Stratford Place, W.1. Phone: Mayfair 4234**

Licensees of Igronic Electric Co. Ltd. for the above products of Cutler-Hammer Inc. Milwaukee, U.S.A.

ENCLOSED RACKS

Imhof rack units are the most up-to-date enclosed racks available. They are made as standard in 6ft. and 4ft. sizes, to take 19in. panels and are 19in. deep. Semi-standard variations are depths of 24in. and widths to take 22½in. panels. Multiple assemblies of any number of racks can be built up requiring only two of the hinged end doors per assembly. The illustration is of a 3-unit assembly, showing one panel half extended on telescopic runners, the desk unit, and the gram unit which are standard extras. Also available are mobile bases for single units, and a large selection of panels, handles, chassis, brackets, etc. Special quotations can be given for non standard variations. Write for illustrated leaflet giving full information.



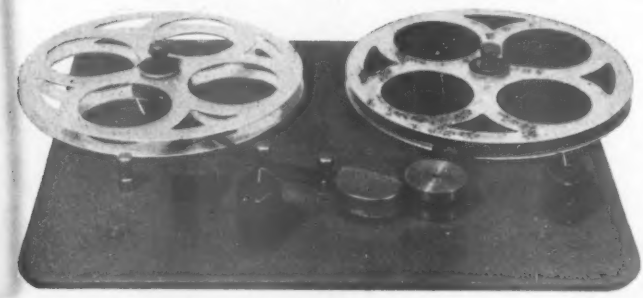
Regd. Design No. 855451

IMHOF'S

ALFRED IMHOF LTD., 112-116, NEW OXFORD STREET, LONDON, W.C.1

Telephone : MUS 7878 (20 lines).

Qualtape Magnetic Tape Recorder



- ★ IMPROVED DESIGN
- ★ NEW FEATURES
- ★ PRECISION MADE
- ★ PERFECTLY BALANCED CAPSTAN DRIVE BY SEPARATE MOTOR
- ★ UP - TO - THE - MINUTE DESIGN. RECORD HEAD, PLAYBACK HEAD, TAPES STOCKED.

The Ideal Tape Recorder for home, office, board meetings. Make your own party records. Use it to improve musical and voice talent. Provide synchronised music and speech for home cine. All these and many more with "Qualtape." Only tools required—
PLIERS, SCREWDRIVER

Complete Kit of Parts £13-13s.

FULL PARTICULARS ON REQUEST TO—

ELECTRONIC SERVICE
(HALLAMSHIRE) LTD.
93-95, BUTTON LANE, SHEFFIELD
Telephone: Sheffield 21690

'Frequentite' is the most suitable insulating material for all high frequency applications. Seventeen years ago we introduced the first British-made low-loss ceramic, and consultation with us before finalising the design of new components is a wise precaution.

STEATITE & PORCELAIN PRODUCTS LTD.

Head Office: Stourport-on-Severn, Worcestershire. Telephone: Stourport 111. Telegrams: Steatain, Stourport

S.P.66

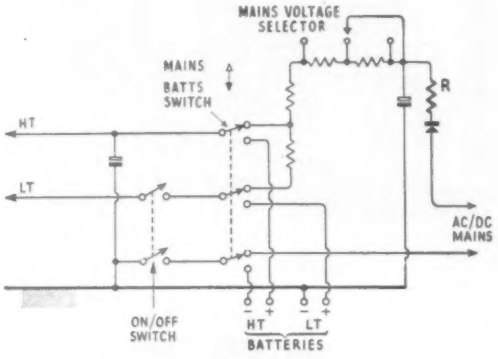
ULTRA GEN No. 1

USING 1·4v VALVES—PROPERLY

The Ultra "Twin" is a portable for use on AC/DC mains, or on batteries. The four valves (plus metal rectifier) are 1.4v miniatures whose filament voltage is obtained from the smoothed HT supply. An important design requirement is that the filament voltage must be maintained substantially constant in the interest of the life of the valves. This is much easier said than done.

This difficulty could arise when the mains input to a normal rectifier circuit is changed from, say, 230v A.C. to 230v D.C. The HT voltage would decrease on the D.C. supply by as much as 25%. This change —added to the normal mains variation that has to be allowed for—is more than could be tolerated. To avoid the necessity for complicated switching to equalise the HT between A.C. and D.C. mains, the Ultra engineers have designed a circuit such that the rectifier efficiency on A.C. mains is adjusted to a value which compensates for the voltage drop which occurs when the set is used on D.C. mains. See resistance R in the diagram. In this way, the HT voltage and filament voltage is maintained substantially constant at the correct value when changing over from A.C. to D.C. mains without the need for switching.

This is just one of the outstanding features of the Ultra "Twin" portable that has made it about the most popular receiver for many years past.



ULTRA ELECTRIC LIMITED
WESTERN AVENUE · ACTON · W.3

Audix

Selected by
"THE COUNCIL OF INDUSTRIAL DESIGN"
for
THE FESTIVAL OF BRITAIN
(SOUTH BANK)

1951

SPEAKER CABINET
(Limited number available for Home Market)

POLISHED and NATURAL OAK and BLACK
FELT LINED
PHASE INVERTER DESIGN
SOFT NON-RESONANT TIMBER
DESIGNED FOR 10" SPEAKER UNIT

Price **£7-5-0**

Audix B.B. Ltd. HOCKERILL WORKS, BISHOP'S STORTFORD, HERTS.
Tel.: BISHOP'S STORTFORD 1394

THE *New* WINDSOR *Television* WOBBULATOR

MODEL 260A

MODEL 260A TELEVISION WOBBULATOR • MODEL 260 A. TELEVISION WOBBULATOR MODEL 26

The first self-contained electronic instrument providing visual alignment facilities for television receivers. Simple, compact and efficient—its use will save many hours of valuable time in the service department.

FEATURES

- ★ **CARRIER FREQUENCY 5-70 Mc/s. 10-140 Mc/s** ***(on 2nd harmonic).***
- ★ **BANDWIDTH 0-5 Mc/s total. 0-10 Mc/s** ***(on 2nd harmonic).***
- ★ **SWEEP FREQUENCY. 50 c.p.s. sinusoidal, return trace blacked out automatically.**
- ★ **OUTPUT. Adjustable from 0-10 mV approx. Fixed and variable attenuators are fitted. Output impedance 75 ohms.**

EARLY DELIVERY.

Please write for further details and information on other WINDSOR and TAYLOR products.

MODEL 260A TELEVISION WOBBULATOR • MODEL 260 A.

WINDSOR *and* **TAYLOR**

Best for TEST EQUIPMENT

TAYLOR ELECTRICAL INSTRUMENTS LTD.
419/424 MONTROSE AVENUE, SLOUGH, BUCKS., ENGLAND

Tel. SLOUGH 21381 (4 lines)
Grams. & Cables : TAYLINS, SLOUGH

Three heads are better than one!

For Standard and Microgroove Recordings

Green Spot with .001" radius sapphire for microgroove recordings.

Red Spot with .0025" radius sapphire for modern standard recordings.

Yellow Spot with .003" radius sapphire for older standard recordings.

These pickup heads are fitted with an easily replaceable armature system complete with a semi-permanent sapphire. Armature mass 20 mg.

Extremely low mass at needle point (4/5 mg. only), allowing for reduction in downward pressure to 10/12 grams for standard recordings, and 5/7 grams for microphone recordings.

Prices: With one head £4 0 0 plus £1 14 8 Purchase Tax. Extra heads each £2 10 0 plus £1 1 8 Purchase Tax. Spare armature system with sapphire 14/8 including tax.

a *Connoisseur* product

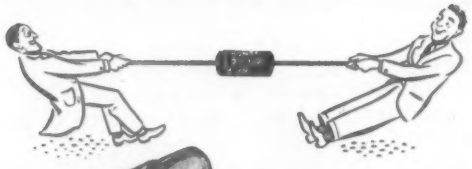
Telephone: HALIFAX 69169

Manufactured by A. R. SUGDEN & CO. (ENGINEERS) LTD., Well Green Lane, Brighouse, Yorks.

TOUGH little chap!

Wkg. Voltage	Cap. Range. μF			★Size
150 D.C.	0.004	to	0.01	A
	0.02	to	0.04	B
350 D.C.	0.001	to	0.003	A
	0.004	to	0.01	B
600 D.C.	2.5pF	to	0.001	A
	0.002	to	0.004	B
300 A.C.	0.00005	to	0.001	A
	0.002	to	0.004	B

★A. 3/16" x 7/16" B. 1/4" x 9/16"



HUNTS W99 leads the way to minimum size with maximum reliability

Really strong end connections are one of the features of the rugged construction of the W99 Midget MOLDSEAL Metallised Paper Tubular. Others are:—

1. Complete reliability—wire leads soldered *directly* to the capacitor unit, giving strength and freedom from intermittence.
2. Self healing.
3. Special moisture-proof moulded casing, developed by Hunts.
4. Insulation resistance: 20,000 megohms or better for all values at working voltage at 20°C.
5. Temperature range.—40°C to + 71°C (types also available for higher temperatures).

Registered Trade Mark

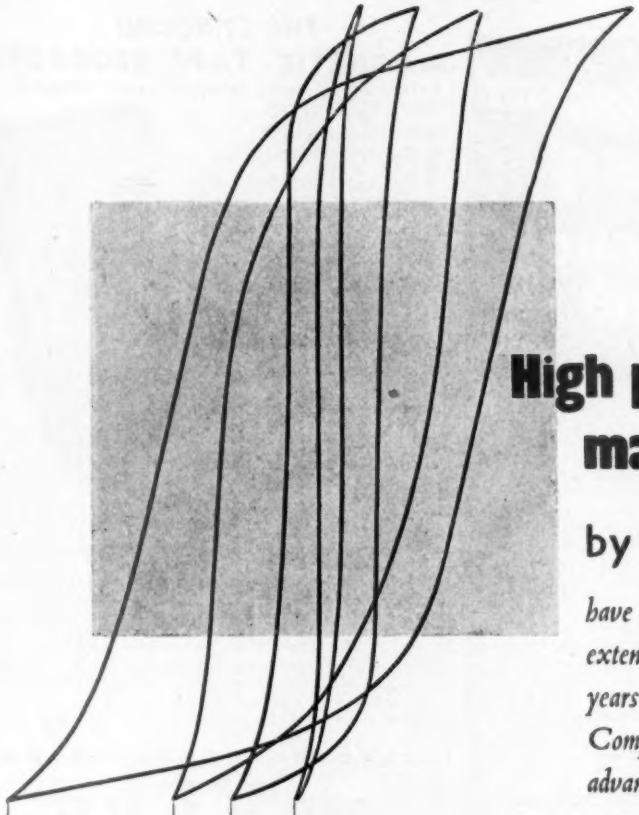
HUNTS CAPACITORS

THE TRADE MARK OF RELIABILITY

Hunts will be pleased to send you full details.

A. H. HUNT LTD., WANDSWORTH, LONDON, S.W.18

Telephone: BATtersea 3131 *Established 1901*



PERMALLOY C for highest initial permeability. Useful for wide frequency band transformers, current transformers, chokes, relays and magnetic shielding.

V-PERMENDUR for high permeability with unusually high flux density. Specially applied to high quality diaphrams and pole pieces.

PERMALLOY B for higher flux densities than Permalloy C and high incremental permeability. Suitable for low power and intervalve transformers.

PERMALLOY D for very high resistivity without undue lowering of maximum flux density or of Curie point. Small variation of permeability with frequency. Ideal for H.F. applications.

High permeability magnetic alloys

by *Standard*

have steadily been improved and extended in range over many years and are produced by a Company which has the unique advantage of being large scale users of these materials.

As a result of this, much direct experience of the requirements and the applications of magnetic alloys is available, thus giving a full appreciation of the desirable characteristics and the actual conditions of use.

Standard Telephones and Cables Limited

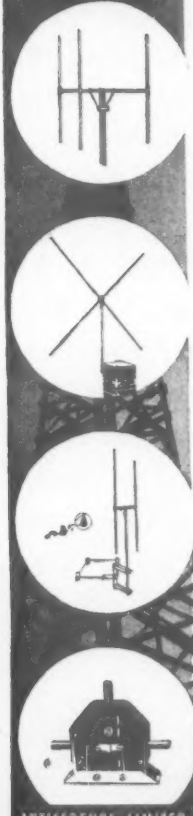
Registered Office: Connaught House, Aldwych, London, W.C.2

TELEPHONE LINE DIVISION North Woolwich, London, E.16 · ALBert Dock 1401

From the comprehensive range of

ANTIFERENCE *Aerials*

FOR TELEVISION & RADIO



From the inception of television Antiference have devoted the whole of their activities solely to the design and production of aerials and aerial equipment. Antiference pioneer work has produced a range of aerials—both television and radio—from which can be selected a model to meet the most critical individual conditions. Below are briefly described typical Antiference products.

1 **The "D6" THREE ELEMENT Television Aerial**
A high-gain model for fringe areas. Provides maximum signal and sharply directional reception.
(*Leaflet C/50/W*)

2 **The "ANTEX" Television Aerial**
Revolutionary in design and performance this aerial provides stronger signals and greater reduction of interference than the standard "H" array. Available with 5ft. and 10ft. mast and chimney or wall mounting, or with pole mounting fitting.
(*Leaflet E/50/W*)

3 **The COMBINED Television and "EXSTAT" Aerial**
Provides interference-free reception of both television and radio.
(*Leaflet C/50/W*)

4 **The "4-WAY" Television Aerial**
A versatile aerial for strong signal areas primarily designed for indoor use, but can be mounted outdoors where signal strength is not adequate for indoor mounting.
(*Leaflet A/50/W*)

Send for the appropriate leaflets as shown above.

All Antiference aerials carry a free 12 months' insurance cover of £250 against lightning damage.

ANTIFERENCE LIMITED · 67 BRYANSTON STREET · LONDON W.1

THE LYRICORD

MAGNETIC TAPE RECORDER

A Recorder of sound straightforward design at a reasonably low price.

FEATURES.

- High Speed Capstan.
- LOW WOW.
- Extreme ease of loading.
- No tape threading.
- INPUTS for high quality moving coil or ribbon microphone or radio.
- Simplicity of operation.
- Records and plays for half an hour on standard reel of tape.

DESCRIPTION.

High Flux 6½" Loudspeaker. Response 50 - 7000 c.p.s. Output power 4 watts. Input channels: (a) 15 ohms. (b) High gain high impedance. Power supply 200-250 volts A.C. 50 cycles. Consumption 80 watts. Tape Speed — 7½" per second. Volume level indicator. Dimensions — 16" × 14" × 12" high. Weight—35lbs.

CONTROLS.

Tape Deck: (1) ON/OFF Master Switch. (2) PLAY/OFF/REWIND Switch. (3) Eraser.

Amplifier: (1) RECORD/PLAYBACK Switch. (2) Volume Control. (3) Tone Control.

Price complete with high quality moving coil microphone and one reel Grade A tape—**£55. 0s. 0d.**

Can be supplied with ribbon microphone and external matching transformers.

N. MIERS & CO. LTD.

115, GOWER STREET, LONDON, W.C.1. *'phone: EUSton 7515*

T.A. 3880

BAKERS 'Selhurst' RADIO

PIONEERS OF MOVING COIL SPEAKERS SINCE 1925

NEW "HIGH FLUX" 1951 MODELS

HIGH FIDELITY SPEAKERS

The World Famous 12" triple cone.

12" Single Cone Model.

18" "Duplex".

Write for illustrated list and technical details of SPEAKERS, TUNERS and AMPLIFIERS.

BAKERS 'SELHURST' RADIO

Dingwall Road, Croydon

Telephone: CROydon 2271/2

Taylor Tunnicliff (REFRACTORIES) Ltd

ALBION WORKS LONGTON STOKE ON TRENT

TELEPHONE: STOKE ON TRENT 5272

LONDON OFFICE: 125 HIGH HOLBORN, LONDON, W.C.1 TELEPHONE: HOLBORN 1951

SIGNAL GENERATOR

TYPE 5

100 KC/S-130 MC/S

PRICE £14.0.0

AT PRESENT AVAILABLE FROM STOCK

The illustration shows our new *SIGNAL GENERATOR TYPE 5* with the back and three internal screen covers removed. Experienced engineers will recognise at once that it possesses all the desirable features for good design and efficient performance, hitherto obtainable only in very expensive instruments.

It is intended for serious work on television, radio and electronic equipment where efficient attenuation and extremely low stray field are essential. Compact, rugged in construction and completely reliable, it is the ideal instrument for use on the test bench and in the service department, etc.

The RF oscillator is triple-screened by means of robust aluminium castings, and the efficiency of this method is further enhanced by adequate filtering of the HT, LT and mains supplies. Attention is drawn to the RF attenuator (bottom right-hand corner) where really efficient screening ensures the effective operation of these vital controls over the whole frequency range.

Send for illustrations and pamphlet S5 which fully describe this remarkable instrument, enclosing P.O. for 2/6 if circuit diagram required.

HOMELAB INSTRUMENTS, 68A COBDEN ROAD, LONDON, E.11

'Phone: LEY. 5651

THE TOOL WHICH PAYS FOR ITSELF ON ONE JOB !

JUNEERO

MULTI-PURPOSE TOOL

CUTTING SHEARS FOR ROD
"XAKTO" GAUGE BAR
BENDING DIE FOR STRIP
CUTTING SHEARS FOR STRIP
PROTRACTOR SLIDE PLATE
BENDING JIG FOR ROD
PUNCH FOR STRIP AND METAL
VICE TO HOLD ROD FOR SCREW CUTTING

Accurately cuts, punches and bends steel and aluminium strip, rod and angles for chassis construction and experimental work on radio and television jobs of all kinds. Indispensable to the busy amateur or professional technician for speedily making valve holders, condenser clips, wire holders, and clips etc. etc. Trade enquiries invited.

20'- PLUS 1/- POSTAGE

Steel strip (10 feet), rod and angle, in 1/- packets. "XACTO" slide gauge 7/6 extra.

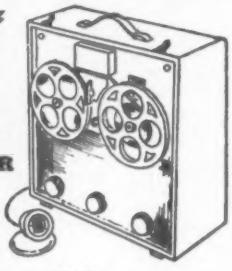
JUNEERO LTD. STIRLING CORNER, BOREHAM WOOD HERTS. Telephone : ELStree 1936.

Delivery from Stock !

Scophony BAIRD

Magnetic Tape

HOME RECORDER



- Complete with mike and one reel of tape.
- Inputs for mike, gram or radio.
- 10 watts push/pull output. Provision for ext. speaker. 30 mins playing time.
- Rexine covered case with lid and carrying handle.

PRICE from MARCH 5th

£58·5·6 NO P.T.

Extra reels of tape £1-5-0

THREE SPEEDS

33⅓-45-78 r.p.m.

MU-14 gram motors. Instant selection of speed required. No belts are used. A.C. only 100-250v 50c/s.

Price £7·3·4 Inc P.T.

DECCA

HI-FI crystal pick-up with TURNOVER head for micro-groove or standard records. Twin sapphires.

Price £3·19·4 Inc P.T.

Frith RADIOCRAFT Ltd

69-71 CHURCH GATE-LEICESTER

MODERN CAPACITOR ENGINEERING

DUBILIER CAPACITORS

THIS modern method of mounting Dubilier Drilitic Capacitors enables the maximum advantage to be secured from the improved electrical characteristics and size reductions, and is one instance of modern capacitor engineering.

No loose parts, clamps, screws or rivets are necessary—a slight twist of the mounting ears and the capacitor is fixed. For chassis capacitor isolation, bakelite mounting plates are supplied; metal plates are available with identical centres for general replacement purposes of the older type capacitors and for interim tooling period.

Ear Mounting Drilitic Capacitors type C.T.E. and C.R.E. have hermetically sealed seamless drawn aluminium containers, have solder tags and are supplied in the usual capacitances and voltages.

Comprehensive catalogues giving detailed information of Dubilier capacitors and technical service are available upon request.

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, N. ACTON, LONDON, W.3

Phone: Acorn 2241 (5 lines). Cables: Hivoltcon, London. Marconi International Code. Grams: Hivoltcon, Westphone, London

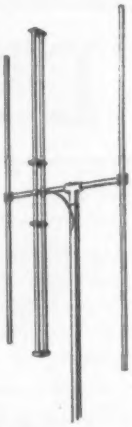
D48A

B

—because we have recently completed demonstrations in the areas shown above, and proved to dealers and others that the Model 63A Folded Dipole gives an extraordinarily good picture in districts previously regarded as "black" areas.

The Model 63A has both gain **AND** broad bandwidth and is the foremost correctly matched high gain Television aerial today. Model 63A with 10ft Dural Mast, **£10/10/-** retail (extra for 16ft mast **£1/8/-**).

Aerialite Limited are the actual manufacturers of all Aerial Equipment for Radio and Television, and we make a full range of Co-axial and Air-spaced Feeder Cables in our Laboratory controlled factories. Lists supplied on request.



Aerialite LTD.

CASTLE WORKS, STALYBRIDGE, CHESHIRE.

M.R. SUPPLIES Ltd

The following selected material, being in new or otherwise excellent condition, I guaranteed to be in perfect electrical and mechanical order. All prices nett. No faulty goods ever despatched.

HIGH DUTY SELENIUM RECTIFIERS. Brand new goods below half price. Funnel-cooled, full-wave, 30 v. 20 amps, **72/6**, 60 v. 10 amp, **72/6** (des. either 2/6). 12 volts 50 amps., **£6**/- (des. 2/6). Pair in bridge: 30 v. 50 amps, **£7** pair, 60 v. 20 amps, **£7** pair, 120 v. 10 amps, **£7** pair (des. 3/6). And others.

STUART CENTRIFUGAL PUMPS from stock! Self-contained motor/pump units, brand new, guaranteed, for 220/250 v. A.C. operation. No. 10 (120 g.p.h.), **£6/10/0** (des. 1/6). No. 12 (600 g.p.h.), **£9/10/0** (des. 3/6). **HIGH DUTY VANE PUMPS** (power required 1 h.p.) details on request. **£6/15/0** (des. 4/6).

PRECISION JEWEL TIPPED GRAMO-NEEDLES. Standard or miniature shank, special limited offer, **2/6**. (Please state which shank.)

TRIPODS FOR P.A. SPEAKERS, all steel, rigid and well-made, extending to 11ft., 55/- (des. England 5/-).

SYNCHRONOUS CLOCK MOVEMENTS, 200/250 v. 50 c. Fitted spindles for hour, minutes, seconds hands, 1-hole mount, silent running, with dust cover 3¼in. dia. and flex, **27/6** (des. 9d.). Set of three plated hands for 3/7in. dial, 2/-.

THERMOSTATS. (Ex-A.M.) Switch 1.5 amp. at 240 v. On at 32 deg. F., off at 49 deg. F., therefore right for frost protection. **4/6** each, **45**/- doz.

VACUO THERMO-COUPLES (S.T.C.) 5 mA (10 mA max.). Unmounted, with four leads. In 2in. by 1in. vacuum tube, brand new, boxed, **8/6**.

SHADED POLE INDUCTION MOTORS (Hoover). Brand new 200/250 v. A.C. H.P.M. constant at 1,200, very silent running. For wire recorders, cine projectors, gram. motors, cooling and extractor fans, stirrers, etc. Body 3¼in. x 3¼in., with shaft each end, **29/6** (despatch 1/-).

G.E.C. RECORDING TAPE. Very latest high coercive (radio quality to 6 Kc/s) 400 yards on standard reel, **30**/- (post paid).

VOLTAGE CHANGING TRANSFORMERS (Portable), 100/110 v.-200/240 v. (and vice versa), auto-wound, loading 1.25 Kva. In steel cabinet 9¼in. x 7in. x 6in., with carrying handle, brand new, **£6/15/0** (des. 5/-). Also same rating in portable steel cabinet 10¼in. x 9in. x 9in., with carrying handle, fitted voltage selector switch with 6/120 v. A.C. meter built in, **£8/17/6** (des. 7/6).

EVERSHED OHM-METERS, ex-Govt. Each instrument expertly overhauled and in perfect condition. Two scales on each, 0/1000 ohms with clear readings of 0.5 up to 100 ohms and 0/200,000 ohms. With carrying case but less flash-lamp battery, **£5/10/0** (des. 1/6).

FLUXMETERS (model WY0023), calibrated in three ranges, 500/1000, 1000/2000 and 2000/4000 Gauss, direct reading. With polarity indicator and probe, less 1.5 v. battery. Brand new in portable case 12in. x 9in. x 6in., **£5/10/0** (des. 2/6).

AIR BLOWERS, fitted Brooks 1/8th H.P. (1/4th H.P. frame). Induction motor, 220/250 v. A.C. 2,500 r.p.m. Outlet 3in. x 2in., reconditioned as new, **£5/7/6** (despatch England 5/6).

DELCO EXTRACTOR FANS, high duty 12in. model. 220/250 v. A.C. Mounting ring 14in. dia. Induction motor **£5/17/6**. Or with protective grille, **£6/5/6**, both carriage paid England and Wales.

EVERSHED BRIDGE MEGGERS (250 v.) S.H. ex-Govt. Each one expertly overhauled before despatch. Range: Megger 0/50 ohms. Bridge .001-100,000 ohms shown in four digit windows, with 10/1 and 100/1 multiplier and divider. With carrying case. **£17** (despatch 4/6).

Despatch costs apply to mainland only.

M.R. SUPPLIES Ltd., 68, New Oxford Street, London, W.C.1

Telephone: MUSeum 2958

AIDS TO EFFICIENCY

Type "K"

S. G. BROWN Type "K" Moving Coil Headphones meet every requirement of those engaged on laboratory and DX work, monitoring, etc. Accuracy is assured by their High Quality reproduction.

D.C. Resistance 47 ohms. Impedance 52 ohms at 1,000 c.p.s. Sensitivity 1.2 x 10-12 watts at 1 Kc=.0002 DYNE/CM2.

S. G. BROWN Type "F" (Featherweight) Headphones derive their popularity with the world's radio enthusiasts, experimenters and servicemen because of their High Sensitivity, Durability and lightness of weight.

D.C. Resistance 4,000 ohms. Impedance 14,000 ohms at 1,000 c.p.s. Sensitivity 8 Dbs. below 1 microwatt per bar at 1,000 c.p.s. —Weight 9 ozs.

Type "F"

Send for Brochure "W," it gives details of all types of S. G. Brown headphones.

S. G. Brown, Ltd.

SHAKESPEARE STREET, WATFORD, HERTS

Telephone: Watford 7241.

RADIO ENGINEERING
RADAR OPERATING
GROUND SIGNALLING
AIR SIGNALLING

Wherever your special interest lies.....

there's a place for YOU in the

R.A.F.

Big things are happening in the Royal Air Force — notably on the radio side where the newest techniques of wireless and radar are now being adopted as standard practice. Men and women of skill and intelligence are urgently needed to take on the operation and maintenance of the newest and most varied equipment. It's a good life and it's packed with interest; pay is good from the start, with all basic living expenses found; and promotion — via the new Technician Ranks — can be extremely rapid. And don't forget: today you can make the R.A.F. a lifetime career with pension up to £5 a week when you retire. Find out more about it: send the coupon now.

Send for your copy of these booklets **NOW!**

TO: ROYAL AIR FORCE, (W.D.24A) VICTORY HOUSE, LONDON, W.C.2

Please send booklet describing life in the R.A.F. (Tick which you require)

A. On the ground		B. In the air	

Name .....

Address .....

..... Age .....

(Applicants from British Isles, only)

★ IF YOU ARE BETWEEN 14 AND 17 — AND KEEN — JOIN THE AIR TRAINING CORPS ★

YOU CAN MAGNETICALLY RECORD
using your Gramophone Motor as a Drive

Necessary parts, also usable later for a more ambitious job, plans available, 1 Spool Diamond Magnetic Recording Tape and 1 take-up spool, 2 Corner Brackets, 1 Roller, 1 Record-playback Head Kit, 1 Friction Clutch, 1 Dual-purpose Supersonic Oscillator and Two-stage Preamplifier and your Radio Chassis. Set of parts £7.15.0 or items supplied separately.

Also Constructional Data for Wire and Tape Recorders 5s.

PARK RADIO OF MANOR PARK, 676/8, 783 Romford Road, London, E.12

WEYRAD

We are pleased to announce several additions to our range of Radio and Television Components.
Our New Catalogue—price Sixpence per copy—gives full details of

INDIVIDUAL COILS—Air-cored, iron-cored and screened types giving coverage from 12.5 to 2,000 metres.

COIL PACKS—Using miniature iron-cored coils. Special versions of particular interest to manufacturers.

BANDSPREAD COIL UNITS—Complete coil assemblies covering nine wavebands—six of which are expanded to an effective scale length of seven inches.

TELEVISION R.F. STRIPS—Complete superhet units with demountable R.F. and oscillator stages giving easy alteration to any channel.

I.F. TRANSFORMERS—At present in quantity production for manufacturers at home and overseas. Miniature, medium and standard sizes.

CHOKES—R.F. and L.F. types. Mains chokes for interference suppression.

In addition to the standard lines detailed above we are fully equipped to carry out all types of winding and assembly work—including power transformers, heavy duty output transformers and units to specification.

WEYMOUTH RADIO MANUFACTURING CO., LTD.,
CRESCENT WORKS, WEYMOUTH. DORSET

ICS

HOME STUDY
backs radio experience with sound technical knowledge

MANY men who wished to link their radio experience with a sound technological background have received successful instruction by means of an ICS Course. Its value has been proved not only to amateurs but to men who already have a professional interest in radio and television engineering, including those taking qualifying examinations. It is invaluable, also, to students who wish to prepare themselves for a job in this field. Courses of instruction covering radio and, if necessary, television, include the following :

Complete Radio Engineering . Radio Service Engineers
Radio Service and Sales . Advanced Short-Wave Radio
Elementary Electronics, Radar and Radio
Television Technology.

And the following Radio Examinations

British Institution of Radio Engineers
P.M.G. Certificates for Wireless Operators
City and Guilds Telecommunications
Wireless Operators and Wireless Mechanics, R.A.F.

Write today for our FREE "RADIO" booklet which fully describes the above ICS Courses and the facilities for the complete study of Radio and/or Television technology. The ICS Advisory Department will also give free and impartial advice on the need for and the means of instruction.

International
CORRESPONDENCE SCHOOLS

Dept. W.L.22, International Buildings, Kingsway, London W.C.2.

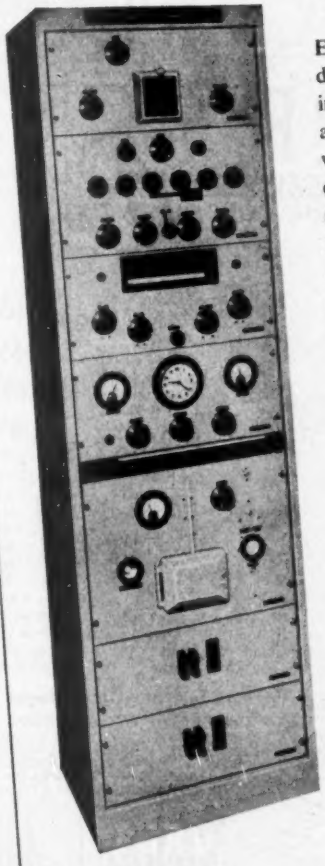
Introducing the lesser known pages of our catalogue

MARCONI INSTRUMENTS LIMITED

Precision

FREQUENCY MEASURING EQUIPMENT

Type TME2



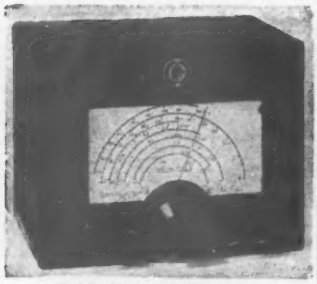
Each year there is a steady but necessarily limited demand for certain "hand-made" Marconi instruments. As often as not the customer is an extremely thankful overseas engineer — one whose difficulties have been resolved by the discovery of our unique specification.

Ordinarily such craftsmanship cannot be lightly bought, but we devote ourselves to solving the economic as well as the technical aspects of a measuring problem. Although the equipment illustrated is created with infinite care, it is well within the reach of those whose operations depend on the precise determination of radio frequencies. And, because of the wave-length allocations accepted by C.C.I.R. delegates, fine frequency discrimination within congested wave-bands is more than ever necessary.

PRECISION FREQUENCY MEASURING EQUIPMENT, Type TME 2, is a complete and self-contained mains-operated installation for the direct indication of frequency in the continuous range 1 kc/s to 30 Mc/s to an accuracy of 1 part in 10^7. This range is capable of extension.

By a stroboscopic method fine discrimination to within a fraction of a cycle per second can be obtained. A synchronous clock enables the accuracy and stability of the crystal to be checked against time signals or astronomical observations.

MARCONI INSTRUMENTS LTD., St. Albans, Herts. Telephone: St. Albans 6161/7

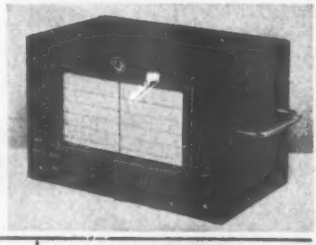


"Q-MAX" V.F.O. (Clapp)
MODEL CV-1
Price 14 gns.

"Q-MAX" BATTERY RECEIVER

- 10-550 METRES
- ALL DRY BATTERIES
- BUILT-IN SPEAKER

MODEL QBT/5 **Price 20 gns.** (Pur. Tax Extra)



IN STOCK

DECCA three speed motor	£7	3	4
Twin head	£3	19	4
CONNOISSEUR twin speed motor	£20	10	3
Pickup with Microgroove head	£5	14	8
Standard head (ex)	£3	11	8
WILLIAMSON AMPLIFIER: Components incl. full range of precision condensers, resistors, etc., and **OUTPUT TRANSFORMERS** by:			
VORTEXION (metal core)	£7	7	0
(Silicor 1 core)	£4	4	0
PARTRIDGE (unpotted)	£5	13	0
(Potted)	£6	0	0
LEAK "Point One" Amplifier	£25	15	0
PC/PA/U remote control Pre-amplifier	£8	15	0
ACOUSTICAL QUAD 12 w. amplifier	£33	0	0
SOUND SALES AZ amplifier	£30	0	0

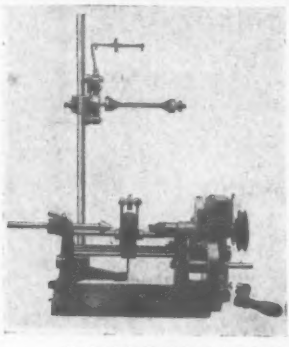
POLYMAX UNBREAKABLE INSULATORS

Stand-offs ¼ in.	4d.
½ in.	9d.
1¼ in.	1/-
Beehive Insulators, 1¼ in.	2/-
Feed-Through	1/3

BARKER Natural Sound Speakers:			
Model 148A	£15	15	0
Model 180	£18	18	0
W.B. Concentric Duplex:			
10in.	£7	7	0
12in.	£15	15	0
GOODMANS TWIN AXIOM	£8	8	0
WHARFEDALE:			
GOLDEN 10in.	£4	17	6
W10/CS 10in.	£8	10	0
W12/CS 12in.	£9	0	0
Speaker switch		13	6
Crossover network	£3	9	6
Microgroove Equalizer	£2	15	0

BERRY'S
(SHORT WAVE) LTD.
25, HIGH HOLBORN, LONDON, W.C.1

"Q-MAX" GDO-1
GRID DIP OSCILLATOR
Price 9½ gns. (with 1 Coil)
Range: 1.5-300 mc/s.
(8 Coils — 3/6 each)



Sole Agents Abroad.

K. G. Khosla & Co., 22, School Lane, New Delhi, India.

Etablts Octave Houart, 14, Quai de L'Industrie, Seiessin-les-Liege.

R. H. Cunningham P.T.Y. Ltd., 62 Stanhope Street, Malvern, Victoria, Australia.

Heftye & Frogg, Oslo, Norway, Storgaten, 15.

MODEL "Q"

AUTOMATIC COIL WINDING MACHINES
AND HAND WINDING MACHINES

Machines supplied complete with stand motor and Two-Speed Friction Clutch

ETA TOOL CO
(LEICESTER) LTD.

29a, WELFORD ROAD, LEICESTER

'Phone—5386

And a Richard Allan extension speaker to go with it Sir?

— if you connect it with flex to your main set you will then have radio in two rooms at the same time. Yes, it is lovely isn't it? This one is called the Major—a lovely cabinet—in fact a lovely speaker for the sitting-room, Sir. Yes, it stops all that messing about when you have company—no need to move your main set about if you have a Richard Allan speaker. Yes Sir, £3 8 6. Thank you, Sir.

Consider these advantages and buy a Richard Allan extension speaker.

BABY 42/- **MINOR** ... 55 - **MAJOR** . 68/6
STANDARD Walnut ... £4 7 6 **STANDARD** Mahogony, light or dark oak ... £4 10 0 **DE-LUXE** ... £4 17 6
CONSOLE Walnut ... £6 15 0

CONSOLE Mahogany £7 10 0 **Richard Allan** **PRESTIGE** Console £13 10 0

RADIO LTD., BAFFLETTE HOUSE, BATLEY, YORKSHIRE

Please note that "BONNIE" and "JUNIOR" models are now out of production.

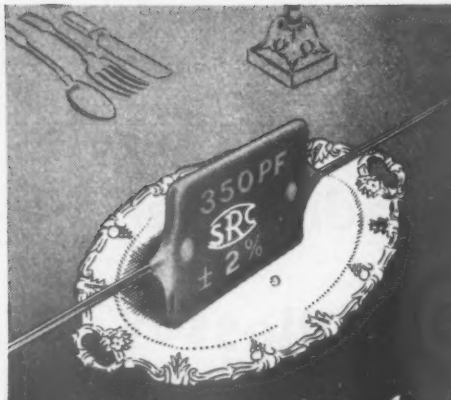
Where there's radio, there's

Plessey

Almost every component required for the production of radio and television is made by Plessey—the largest manufacturers of radio components in the Commonwealth. The name Plessey is a guarantee of fitness for purpose and reliability, whether on a simple or a complex component. Full details can be found in the large selection of Plessey descriptive literature, for which executives in the industry are invited to write.

THE PLESSEY COMPANY LIMITED
ILFORD · ESSEX
TELEPHONE: ILFORD 3040

Overseas Sales Organization
PLESSEY INTERNATIONAL LIMITED



Precious Silver

In these days of steadily rising raw material prices precious Silver has become even more precious. For Silver, however, there is no substitute; Electrodes of our Capacitors are made from pure Silver; Contact Foils and Wire Ends are Silver plated.

The specialists for Silver Mica Capacitors

STABILITY RADIO COMPONENTS LTD.

COMMERCE ESTATE, WOODFORD AVENUE, LONDON, E.18.

BUCKHURST 6501/2

Here's the **Master POCKET Set!**

THE TRIMMER KIT

which no Amateur or Professional Radio or Television Engineer can afford to be without.

25/6 POST FREE

Contains

- ★ 1 End Trimmer
- ★ 1 Side Trimmer
- ★ 1 Yaxley Switch Contact Adjuster
- ★ 1 Low Capacity Trimmer
- ★ 1 Screwdriver
- ★ 1 Set of Feeler Gauges
- ★ 1 Set of six Box Spanners from 1 to 8 B.A.
- ★ 1 Set of four Spanners from 0 to 8 B.A.

In durable black crackle finish metal case

Order from:

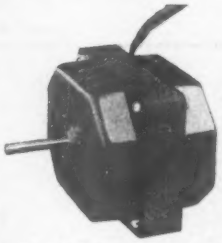
J. & S. NEWMAN Ltd. 100 Hampstead Road, N.W.1. *Tel. Euston 5176.*

BSR Induction Motors..

FOUR POLE MOTOR FP.10

A precision engineered well balanced motor, designed to give constant, trouble free performance indefinitely. This motor is used extensively in many wire and tape recorders, and gramophone units now manufactured.

Note these features:—Fully protected • Dual voltage range • Negligible external magnetic field • Oil impregnated self aligning bearings • Speed constancy and silent running.



Speed (light) 1400 r.p.m. Torque 5 inch ozs. Weight 1¾ lbs.

TWO POLE MOTORS SR1 & SR2.

A rugged and highly efficient motor that will stand heavy overloads, and for intermittent ratings is capable of giving up to twice the rated power. Used extensively in many motion displays, fans and gramophones now manufactured. SR1 MODEL; Speed (light) 2750 r.p.m. Torque 3.0 inch ozs.—Weight 2.31 lbs. SR2 MODEL; Speed (light) 2750 r.p.m. Torque 2.0 inch ozs.—Weight 1.7 lbs.

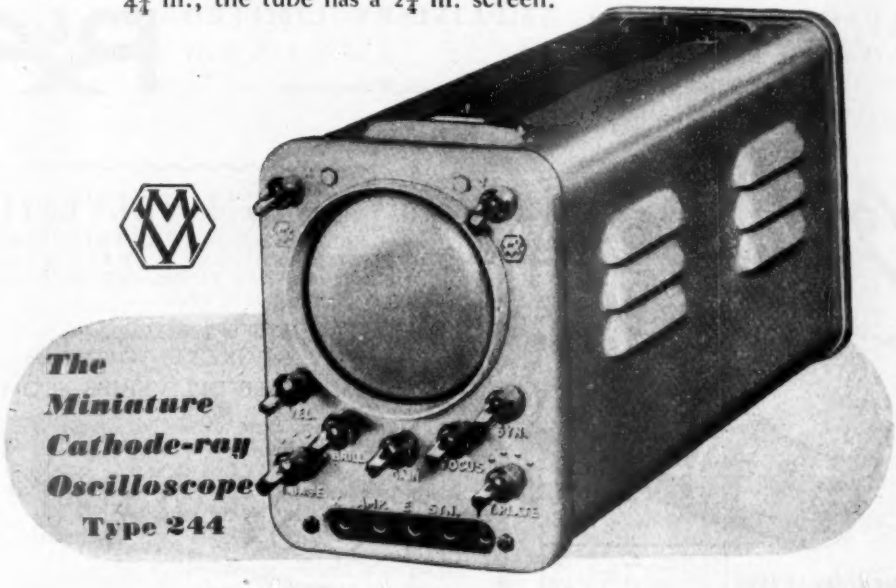
..Leaders in their field

Birmingham Sound Reproducers Ltd., Old Hill, Staffs. Tel. Cradley Heath 6212/3

To the electrical and radio service engineer . . .

An oscilloscope in miniature . . .

The criterion of usefulness of a cathode-ray tube as an oscilloscope is the ratio of the screen diameter to the diameter of the spot but there is a practical limit to the extent to which the screen diameter can be reduced, even though the spot size is reduced in proportion. One outstanding feature of this oscilloscope is the comparatively large screen for an instrument of such small dimensions. Although the overall dimensions of the case are 11½ in. × 5¾ in. × 4¼ in., the tube has a 2¾ in. screen.



METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

TRAFFORD PARK, MANCHESTER 17

Member of the A.E.I. group of companies

RE/902

METROVICK—*Pioneers in Radio and Electronic equipment*

Question Answered . . .

WHAT IS 'CHEAPNESS'? Is it low initial cost . . . just the figures on the invoice? Or is it the sum of good design, good materials, and good workmanship—coupled with delivery to schedule and a reasonable and *economic* price? Where loud-speakers are concerned, we know what the answer should be.

If radio sets 'wore out' in a year, then money spent on reliability would be sheer waste. But as they are designed to last—perhaps too long!—'saving' a few pence on the speaker can be false economy indeed.

R. & A. Reproducers are *cheap* in the real sense. Let us send samples and technical information, so that you can prove this for yourself.

REPRODUCERS AND AMPLIFIERS LIMITED
WOLVERHAMPTON · ENGLAND
Telephone: Wolverhampton 22241. Telegrams: Audio, Wolverhampton

R&A

Only with CO-AX R.F. CABLES
AIR-SPACED ARTICULATED
4mmfft
Patents Regd. Trade Mark

LOW ATTEN TYPES.	IMPED OHMS	ATTEN at 1000 kc/s per 100 ft	LOADING Min. at 1000 kc/s	O.D."	
A1	74	1.7	0.11	0.36	
A2	74	1.3	0.24	0.44	
A36	73	0.6	1.5	0.88	HIGH POWER FLEXIBLE
LOW CAPAC TYPES.	CAPAC mmf/ft	IMPED OHMS	ATTEN at 1000 kc/s	O.D."	
C1	7.3	150	2.5	0.36	
PC1	10.2	132	3.1	0.36	PHOTOCELL CABLE
C11	6.3	173	3.2	0.36	
C2	6.3	171	2.15	0.44	
C22	5.5	184	2.8	0.44	
C3	5.4	197	1.9	0.64	
C33	4.8	220	2.4	0.64	VERY LOW CAPACITANCE
C44	4.4	252	2.1	1.03	

THE LOWEST EVER CAPACITANCE OR ATTENUATION
IMMEDIATE DELIVERIES
SPECIALISTS IN AIR-SPACED ARTICULATED CABLES SINCE 1929
TRANSRADIO LTD
CONTRACTORS TO H.M. GOVERNMENT
138A CROMWELL ROAD LONDON SW7
ENGLAND

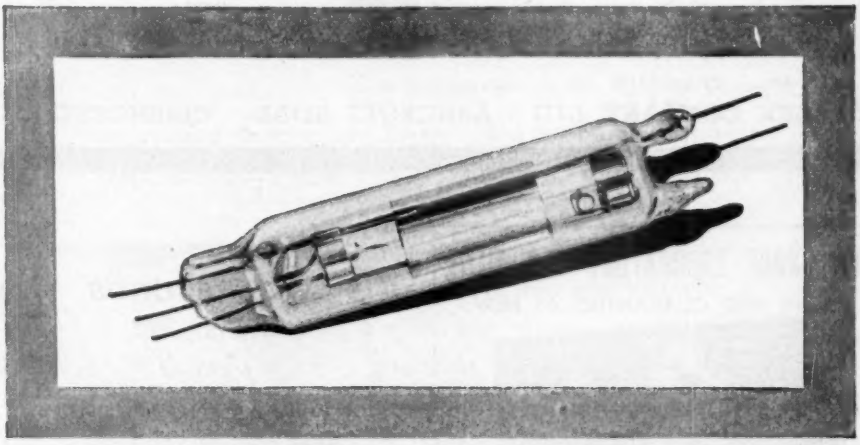
VALVES!! VALVES!!
RECEIVING, TRANSMITTING, MAGNETRONS, KLYSTRONS, CATHODE-RAY TUBES, PHOTOCELLS, ETC.
LARGE QUANTITIES & GREAT VARIETIES
IMMEDIATE DELIVERIES FROM STOCK
WRITE OR 'PHONE:—
S. Szymanski
(pronounced SHE-MAN-SKEE)
ELECTRONIC ENGINEER & STOCKIST
95 STRODES CRESCENT
STAINES - MIDDLESEX
TELEPHONE: STAINES 3971
PROBABLY THE LARGEST ACTUAL STOCKIST IN ENGLAND
WHOLESALE & EXPORT ONLY

OF INTEREST TO PHYSICISTS

Osram

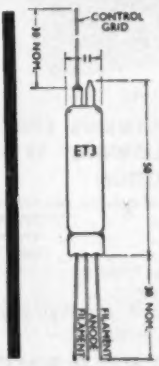
Sub-miniature Electrometer Triode

TYPE E.T.3.



Whilst having a performance comparable to the older type electrometers with regard to stability and input resistance, the Osram E.T.3 has the added advantage of smaller physical size which enables the valve to be sealed into vacuum systems etc.

In addition, a low filament current is required which, with the voltage rating of the filament, enables it to be operated from a small dry cell. In this sub-miniature Electrometer Valve, the input resistance is better than 10^{14} ohms.
Full details of the E.T.3 may be obtained from Osram Valve and Electronics Dept., Magnet House, Kingsway, W.C.2.



RATING :

Filament Voltage	1.25 volts
Filament Current	0.025 amp.
Anode Voltage	9 max. volts
Amplification Factor†	1
Mutual Conductance†	70 μA/V
Insulation Resistance‡	> 10^{14} ohms

† Measured at $V_a = 6$, $V_g = -2$

‡ Measured at $V_a = 6$, $V_g = -3.5$

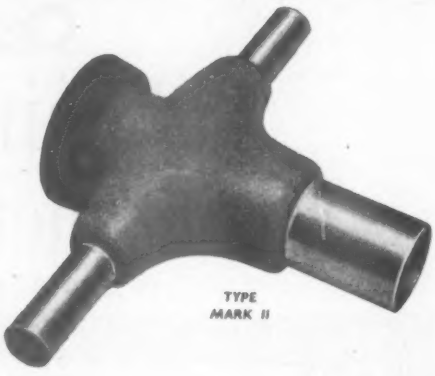
Capacitance, Grid to all other electrodes	1.3 pF
Capacitance, Grid to Anode	0.2 pF

THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE KINGSWAY, W.C.2

MYCALEX
(REGD. TRADE MARK)
THE INSULATOR

- Watertight assembly.
- Long leakage path.
- Element rods reinforced by the inserted metal tubes, at a point where fracture is liable to occur.
- Mycalex has high surface resistivity to moisture under damp conditions.
- Great physical strength due to nature of Mycalex which is a bond of Mica and Glass.
- Electrical connections easily accessible by means of removing the tough rubber end cap illustrated.

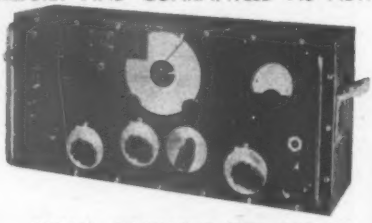
MYCALEX TELEVISION DIPOLE and REFLECTOR AERIAL MOULDINGS



TYPE MARK II

'Phone : CIRENCESTER 400 or send enquiries to
MYCALEX COMPANY LTD · ASHCROFT ROAD · CIRENCESTER GLOS

HIGH GRADE LABORATORY EQUIPMENT
REBUILT AND GUARANTEED AS NEW



SIGNAL GENERATOR TYPE T.F.144G

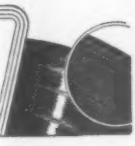
WE HAVE A COMPREHENSIVE STOCK OF WHICH THE FOLLOWING IS A SMALL SELECTION

Valve Voltmeters Type TF428B	Signal Generator Type TF144G			
Oscilloscope Type 208 Dumont	"	"	"	TF617F
Universal Bridge Type TF373D	"	"	"	TF390G
Signal Generator Type 18B	"	"	"	605B
Beat Freq. Oscillator Type TF195L				

For further particulars of this and other high-grade electronic instruments, write to :—

HATFIELD INSTRUMENTS
175 UXBRIDGE RD., HANWELL, LONDON, W.7
Telephone : EALING 0779

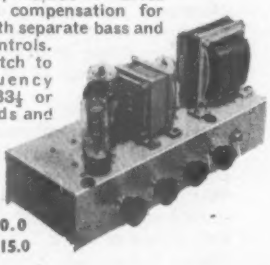
L. P. RECORDS
sound better still . . .
if you fit



GRAMPIAN

MODEL 492 4-watt AMPLIFIER UNIT

For A.C. mains, 110/260 v. Gives necessary bass compensation for L.P. records with separate bass and treble tone controls. Fitted with switch to correct frequency response for 33⅓ or 78 r.p.m. records and also radio input position.



Retail price £17.0.0
Cover extra £1.15.0

Write for details to

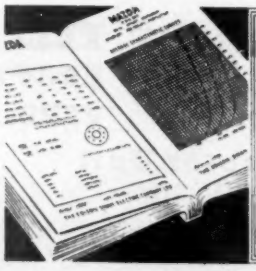
GRAMPIAN REPRODUCERS LTD
9 HANWORTH TRADING ESTATE, FELTHAM, MIDX.
Telephone : FELtham 2657/8. *Telegrams :* "Reamp. Feltham."

18280C

We can't believe you're not

interested

If you were offered a 340 page book crammed full of valuable valve data, characteristic curves and circuit diagrams, none of which was available elsewhere, you wouldn't think 2/- was a high price. That's exactly what is offered in the 1949/50 Ediswan Mazda Valve Manual.



It's different from most manuals of its type because instead of replacing the previous issue *it devotes the whole of its pages to completely* new *information.*

We can't believe you're not interested, that's why we've got a copy packed ready to put your name on—send Postal Order 2/6 to include postage and packing—today!

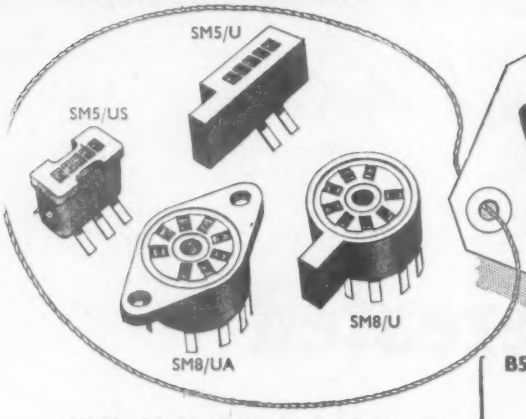
Technical Publications Department,
THE EDISON SWAN ELECTRIC COMPANY LTD.
155 CHARING CROSS ROAD, LONDON, W.C.2

Member of the A.E.I. Group of Companies

E737

Recognised as the Most Reliable Valveholders

Sub-Miniature Valveholders



McMURDO Moulded Valveholders

All Moulded in Silica-loaded Polystyrene

B5A TYPES
SM5/U. Panel Mounting
SM5/US. Chassis Mounting

B8D TYPES
SM8/U. Panel Mounting
SM8/UA. Chassis Mounting

THE McMURDO INSTRUMENT COMPANY LTD., VICTORIA WORKS, ASHTEAD, SURREY · ASHTEAD 3401

SUCCESS?

START HERE

Never before has such a vast field of opportunity been open to the technically minded. Because we can call on the unique experience of the great E.M.I. Group ("H.M.V.", Marconiphone, etc.), our courses are based on the needs of modern industry. Let us help you to take advantage of the great demand for technicians in Radio, Television and all branches of Engineering. Take the first step NOW!

—FILL IN FOR FREE BROCHURE—

Mark the subject(s) which interest you, and post (without obligation): E.M.I. INSTITUTES, Dept. 16, 10 Pembridge Square, London, W.2.

☐ Mechanical Eng. ☐ Aeronautical Eng. ☐ Radio
☐ Production Eng. ☐ Draughtsmanship ☐ Matric
☐ Electrical Eng. ☐ Television ☐ Civil Service
☐ Other Subjects .....

NAME .....

ADDRESS ..... (BLOCK CAPITALS)

E.M.I.—the industry behind the College

T.2ca

SPHERE INSTRUMENTS

TELEVISION ADAPTOR UNIT TYPE S.C. "88"

Adaptor Unit S.C. "88" eliminates costly troublesome conversions

IT ADAPTS THE "LONDON"-DESIGNED TELEVISION RECEIVER FOR SUTTON COLDFIELD RECEPTION—PERFECT SOUND AND VISION

Small and compact, the unit, embodying power-pack, and all the necessary "works," is simply fitted between aerial and set. Set itself is entirely untouched, and in its original state—thus retaining its full "design-efficiency." Of particular interest to "Fringe" viewers. Real saving of time, trouble and cost.
Full details supplied. **Price 7 Gns. nett**

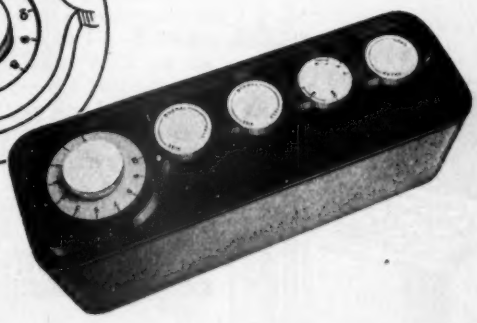
Two models: "L" for 30/35 miles radius of transmitter
"F" for "Fringe" areas.

Manufacturers:

SPHERE RADIO LIMITED
HEATH LANE, WEST BROMWICH, ENGLAND

★ A POINT OF DETAIL NO. 2 ★

"Volume"



In any amplifier capable of high quality reproduction, the influence of the volume control is significant and worthy of more attention than it receives in most "specifications." In the Q.U.A.D. final test pass figures, the effect of the volume control is an integral part of at least four measurements.

a. The frequency response of the complete equipment when set to level is within 0.3 db in the range 20-20,000 c/sec., *these figures being maintained at all settings of the volume control.*

b. The scale is divided into ten divisions. The grading of volume attenuation obtained is checked for accuracy within *one half of one division to a standard loudness scale.*

c. Distortion figures are measured with inputs up to ten times higher than those required to fully load thus ensuring that *these figures will not be exceeded under practical conditions.*

d. The control itself operates by combined feedback and normal potentiometer action. In this way, background is *never more than −75 db or 4μV at the input,* whichever is the greater.

These may appear small points in themselves and they are no doubt covered with some degree of test in most amplifiers. Nevertheless, it is well to remember that the performance figures of the Q.U.A.D. amplifier are those which will be obtained in normal use and are not conditional upon exactly matched or balanced valves, non-reactive loads, low source input impedance, or other factors difficult or impossible to maintain in practical applications.

THE ACOUSTICAL Q.U.A.D. AMPLIFIER

An amplifier capable of providing the closest approach to the original sound. Write for the Q.U.A.D. booklet for full detailed specifications.

£38 *complete in two units as illustrated.*

ACOUSTICAL
MANUFACTURING CO LTD
HUNTINGDON • HUNTS • TEL: 361

Magic New Entertainment for Every Home!

It is a fascinating pastime making your own personal recordings—and so simple that everyone can do it. The amazing Soundmirror Magnetic Tape Recorder will record with perfect fidelity music, from a song to a full orchestral score; speech and the fun and frolic of family parties, as well as important and family events such as weddings. Think of the pleasure these recorded items can give you when you play them back to entertain the family and your friends.

Soundmirror
MAGNETIC TAPE RECORDER

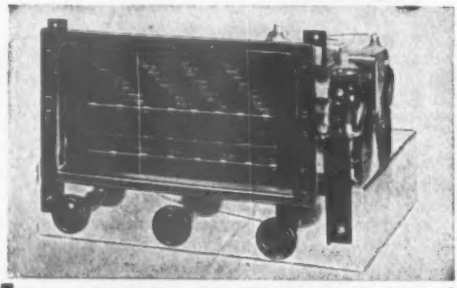
Models from **£69.10.0** *exclusive of microphone*

Call on your local radio dealer and hear your own voice recorded, or write for Brochure, which gives full details, to the manufacturers.

THERMIONIC PRODUCTS LTD.

Sales and Service Centres: Manchester, Birmingham, Bristol, Leeds, Newcastle, Glasgow etc.

Head Office: Hythe, Southampton. *Phone:* Hythe 3265
London Showrooms: Morris House, Jermyn St., Haymarket, S.W.1. *Phone:* Whitehall 6422



BUILD WITH OUR HANDSOME HOME CONSTRUCTION UNITS!

ANYONE can build this magnificent SUPERHET:

Using the **new and improved** unique point-to-point Construction Sheets for our famous 5 v. A.C. Super (with the latest 30 Tuning Unit) **YOU** can, for an evening's entertaining construction, complete a receiver (without ANY test gear) whose selectivity, range and overall performance will at least equal that of commercially built units at double the cost!

As our delighted friends already know the secret lies in using our pre-aligned **30 TUNING UNIT** comprising the famous 3 band 30 Coil pack. "**MM**" I.F.T.'s, new 8in. x 6in. 3 colour Dial and J.B. 2-gang—READY ALIGNED, MATCHED and SEALED! Price **90/9** (inc.) or **90/6** with J.B. S.L.S. spin-wheel Tuner.

NOTE to Connoisseurs:—Our 40 Feeder using R.F. model 40 Tuning Unit with HI-FI switching for local stations (and Gram.) with 10w. push-pull Quality Amplifier and variable negative feedback is the TOPS! (Ideal with Williamson.)

"Letters of praise received daily from beginners and experts!" — — — — — — **F.J.M.**, of S.E.14, states: ". . . . it does all you claim . . . I had the surprise of my life when it went perfectly first time—it is the best set I've ever heard." For constructional details, illustrations, eleven circuits, data, etc., send 2/- NOW for LATEST EDITION of "Home Constructor's Hand-book."

RODING LABORATORIES
(OF ILFORD)

MAIL ONLY to 694, Lea Bridge Road, Leyton, E.10.

"You're CERTAIN to get it at ARTHURS!"

★ **VALVES:** We have probably the largest stock of valves in the country. Send your enquiries.

AVO METERS IN STOCK

Avo Model 7	£19 10 0
Avo Model 8, high resistance	£19 10 0
Avo Model 40	£17 10 0
Heavy Duty	£13 13 0
Valve Tester	£16 10 0
Avo Minor, AC/DC model	£10 10 0
Electronic Test Meter	£40 0 0
Signal Generator	£30 0 0
Valve Characteristic Meter	£50 0 0
Universal Bridge	£24 3 0

★Demonstration of Philips Projection Television set in our showrooms.

VALVE MANUALS
Mullard - - - 5/-ea
Mazda: Part 1, 1/- Part 2, 2/-
Brimar - - - 4/-
Radio Valve Replacement Guide 1939-50, 2/6
Post 9d. each extra.
Send for catalogue.

TAYLORS METERS. List on request
DECCA PICK-UPS £3 15 5
DECCA HEAD £2 19 2
ADAPTOR for Garrard 3 8

All goods subject to price alterations and being unsold.

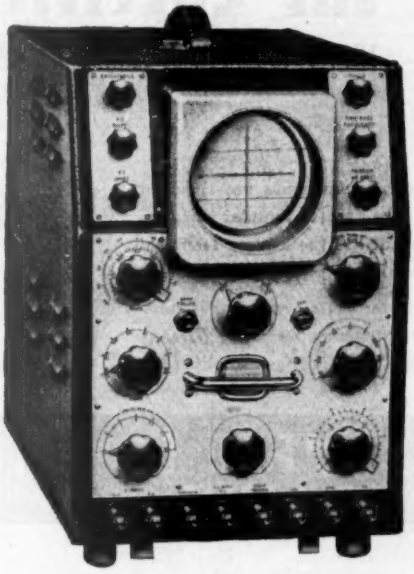
LONDON'S OLDEST LEADING RADIO DEALERS

Arthurs EST. 1919
PROPS: ARTHUR GRAY, LTD. *Terms C.O.D. or cash with order*

Our Only Address. **Gray House, 150/152 Charing Cross Rd., London, W.C.2** *TEMple Bar 5833/4 and 4765*

ELECTRICAL, TELEVISION & RADIO ENGINEERS

THE COSSOR DOUBLE BEAM OSCILLOGRAPHS



Can this Instrument solve a problem for you?

Here are some details of Model 1049 as illustrated: The Double Beam Tube presents two simultaneous independent traces over the full diameter of a 90 mm. screen, and provision is made for the measurement of both input voltage and time upon the calibrated dials of the instrument. The Oscillograph is particularly suitable for obtaining permanent photographic records using the Cossor Model 1428 Camera for which a Motor Drive Attachment Model 1429 is available.

★ ***Festival of Britain***
This instrument has been selected for exhibition in the Dome of Discovery (research feature) and in the Floating Exhibition on S.S. "Campania."

Widely different industries are daily finding new uses for the COSSOR Double Beam Oscillograph. Sometimes it provides the answer to an industrial problem of long standing. The tracing and measurement of noise, strain and vibration are typical everyday applications of this versatile instrument which is already helping engineers in industries as far apart as brewing and the manufacture of jet engines. Call on our technical advisory staff if you have a problem. They will quickly let you know whether the Oscillograph can help you.

COSSOR

Double Beam OSCILLOGRAPHS

Please address enquiries to:
A. C. COSSOR LTD., INSTRUMENT DIVISION (Dept. G), HIGHBURY GROVE, LONDON, N.5.
Telephone: CANonbury 1234 (30 lines) CI.21

WHEN TRANSFORMERS ARE SPECIFIED

THE NAME IS USUALLY WODEN

Woden components are specified for the most popular circuits published in the leading technical journals.

Send for catalogue and details of components for the "Wireless World" Williamson Amplifier.

WODEN TRANSFORMER CO. LTD.
MOXLEY ROAD BILSTON · STAFFS · PHONE: BIL. 41959

I.T.L.

BALDWIN

VISUAL NULL INDICATOR
for A.C. Bridges

Range 20 c/s to 20 kc/s.

The Sensitivity which is adjustable from zero is higher than that of headphones. It is very robust and will withstand considerable overloads — no acoustic shock. Operates on A.C. mains.

BALDWIN INSTRUMENT CO. LTD.
DARTFORD, KENT *Dartford 2989 & 2980*

RADIO'S "PUZZLE CORNER" cleared up with an OSMOR "Q" COILPACK

As specified for conversion of the Type 26 unit of the T.R.1196, also Type 18 and wartime utility receivers, etc.

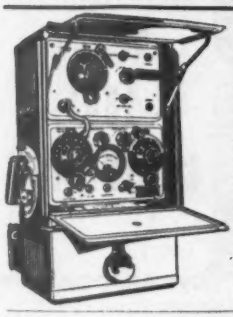
Send 5d. (stamps) for complete receiver circuits, also lists of Coils, Coilpacks and all Radio Components.

Your coil and switching problems are solved in a matter of minutes with the pre-aligned OSMOR "Q" Coilpack. No complicated wiring circuits — just five simple connections and you're all set for better 'whistle-free' listening. All types available for mains and battery sets, complete with full instructions and circuit diagrams.

OSMOR RADIO PRODUCTS LTD. (Dept. W.18)
BRIDGE VIEW WORKS, BOROUGH HILL, CROYDON, SURREY
Telephone: CROYDON 1220.

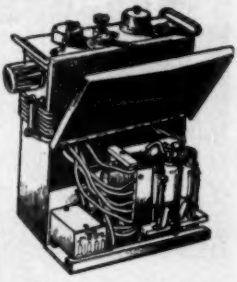
LONDON CENTRAL RADIO STORES

Government Surplus – Immediate Delivery from Stock



WALKIE - TALKIE (Transmitter-Receiver) Type 48 (Mk.1*). Brand New Ex-U.S. Army. Frequency coverage 6-9 Mc/s. Comprises transmitter/receiver with 10 valves and one 1-Mc/s crystal, in metal case with waterproof cover, sectional rod aerial in satchel. Spare valve case, complete with 10 spare valves, key assembly, hand microphone, two headsets, one hand generator (10 watts) with tripod as illustrated in April issue, two battery boxes, all essential connecting cables. The complete equipment together with comprehensive instruction manual. Price (Inland only). **£24.10.0**

TELESONIC 4-VALVE BATTERY PORTABLE (Fixed Range). Type YA4015. Including three XH and one XP Hivac midget valves. Can be adapted for Deaf Aid or Midget Receiver, but we do not supply information on this point. Batteries required 3 v. L.T., 97 v. H.T. In metal case, size 5¼ × 7 × 2in. Weight 4lb. Less batteries Carr. & Pkg. 2/6. **45/-** (Illustration shows chassis partly removed from cabinet.)



WESTINGHOUSE METAL RECTIFIERS. Type H.T.10, 35 fins. Size 6 × 2½ × 2½in. Carr. & Pkg. 1/6. **15/-**

Photo-Electric Cells Type G810

These cells are the gas-filled type with caesium Cathode. Made by Cintel. Minimum sensitivity 100μA/lumen working volts 100 D.C. or peak A.C. Projected cathode area 16 sq. cm. Suitable for 16 mm. Home Cinema Talkie equipment, Safety Devices, Colour and Photo Matching, Burglar Alarms, Automatic Counting, Door Opening, etc. Brand new in original cartons. **42/6**

An Exceptional Offer!

CHEVROLET CAR RADIO RECEIVERS. 9 valves, 5 wavebands, 6 volt. This product of General Motors is exceptional value. Size 14in. wide × 9½in. deep × 9in. high, graduating to 5½in. at back. Carr. & Pkg. 7/6. **£15.10.0**

H.M.V. RADIO AND TELEVISION CONSOLE. 4 waveband 6 valve Radio, 12in. Tube Television with indirect viewing (mirror in lid), handsome walnut cabinet of super quality, size 39in. high × 19in deep × 36in. wide. In perfect working order. Owing to size and weight these are **for callers only.** Price **£55.**

New INERT CELL ACCUMULATORS Everlasting. No acid or charging required. Suitable for electric bells, etc. 1.5 v. **2/10** or **7/6** for three. Post free.

MAP READING TORCH. Powerful magnifying lens, 3in. diam. In bakelite case. Fitted with dimmer switch. Takes 2 U2 cells. With bulb, less batteries, **2/6.**

NEW NIFE ACCUMULATORS. 2.5 v. 2½ amp./hours for 8 hours. Size 3 × 4½ × 1¼in. (Flat) **5/6** Post & Pkg. 9d.

ASTRA COMPASSES. Complete with transit box. Useful for surveying, etc., **15/6.**

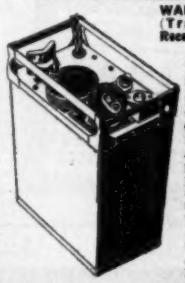
UNISELECTOR SWITCHES.
4-bank, full-wipers **37/6**
6-bank, half-wipers **27/6**
3 bank, full-wipers **19/6**
Have various applications, including automatic tuning circuit selection, etc. Operates on 25-50 v.

VOLTMETERS. Centre zero reading 0-3 and 0-30 D.C. **17/6**

VIBRATORS, 2-VOLT, Type R76C. 7-pin self-rectifying. Output 200 v. at 60 mA. Made by Electronic Laboratories Inc., **7/6.**
6-VOLT, Type 560. 6-pin self-rectifying, **7/6.**
MALLORY, Type 650, 6-volt 4-pin American base, **7/6.**
MALLORY, Type G629C. 12-volt, 4-pin, American base, **7/6.**

BUBBLE SEXTANTS MK. 9A. Equal to new. Complete with 6 extra bulbs, **37/6.** Ditto, Mk. 9, **27/6.**

PHOTO ELECTRIC CELLS, TYPE GV142. Small infra-red image glass converter, tube, 50-100 v. Suitable for all purposes. N.B.—We cannot enter into correspondence regarding these. **14/6**

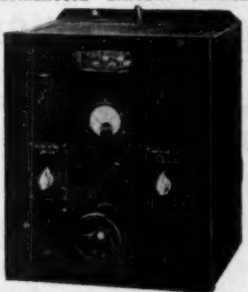


WALKIE - TALKIE (Transmitter and Receiver) CHASSIS, type 38 Mk. II. Range 7.4-9 Mc/s. Requires 3 v. L.T., 120/150 v. H.T. In perfect working order. Complete with four ARP12, one ATP4 valves, one pair throat mikes, pair headphones and aerial. In metal case. Free wiring diagram. Batteries not supplied. Carr. & Pkg. 2/6. **£3.8.6**

WESTINGHOUSE BATTERY CHARGER.

Size 16 × 16 × 22in. A.C. 200-250 v. 50 cycles. Output 6-8 v. D.C., 32 amp. Weight approx. 140lb. Price **£20 . 0 . 0** Carr. & Pkg. 20/-.

WESTINGHOUSE BATTERY CHARGER.



Size 16 × 14 × 12in. A.C. 200-250 v. 50 cycles. Output D.C. 185 v. 0.75 amp. Weight approx. 50lb. Price **£8.15.0** Carr. & Pkg. 15/-.

PHILCO 5-VALVE SUPERHET RECEIVERS (Reconditioned)

A.C or A.C./D.C., 200-250 v. Built-in 8in. mains-energised speaker. In walnut cabinets (soiled) size approx. 19 x 13 x 10in. Every set has been overhauled at works.

2-waveband (Med. and Long) .. .. £4 . 10 . 0
3-waveband (Short, M. & L.) .. .. £6 . 10 . 0

Carriage and Packing, 7/6 each.

N.B. There is a shortage of Utility Sets, but we have been fortunate in replacing these with the above excellent receivers.

Please Note: All carriage charges relate to the British Isles only • We do not issue lists or catalogues

LONDON CENTRAL RADIO STORES, 23 LISLE ST. (GERrard 2969) LONDON, W.C.2

Closed Thursday 1 p.m. Open all day Saturday and weekdays 9 a.m.—6 p.m.

Inside the transept of the Crystal Palace, showing the "Sibthorp" elms.

TELCON at the 1851 EXHIBITION

TELCON METALS
TELCON CABLES
TELCON PLASTICS

Telcon's founder, The Gutta Percha Company, exhibited at the Crystal Palace in Hyde Park and was awarded one of the coveted Council Medals of the Exhibition. In 1850 it had made the first submarine telegraph cable to be laid between England and France, the centenary of which was celebrated last year. From such adventurous beginnings has grown the present Telcon organisation, the activities of which now cover a wide field in engineering and industry at home and overseas. Again, in 1951, the Festival of Britain Exhibition includes some examples of the outstanding Telcon developments of the present century.

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD.
Head Office: 22 Old Broad St., London, E.C.2. Telephone: LONdon Wall 7104
Enquiries to: Telcon Works, Greenwich, S.E.10. Telephone: GREenwich 3291

TELCON

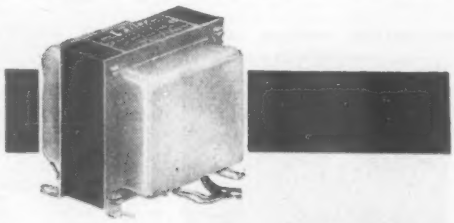
VARIABLE HIGH VOLTAGE LABORATORY & GENERAL PURPOSE POWER SUPPLY

TYPE 103 PMA

Input - - -	230 V.A.C. 50 c/s
Output - -	500-12,000 V 1 mA maximum
Meter - - -	Calibrated 0-12 KV.
Case - - -	Blue stove enamelled steel case, 20½" x 10½" x 10½"

Full details of our standard equipment from 2,000 to 50,000 volts are available.

HAZLEHURST DESIGNS LTD
34a, POTTERY LANE
LONDON, W.11
TELEPHONE: PARK 6955



MAINS TRANSFORMERS & CHOKES

Varley REG. TRADE MARK

All "Varley" products are manufactured from the highest quality materials.

Transformers, etc., are individually wound and have interleaved windings with ample insulation, ensuring freedom from breakdown.

The comprehensive range of Shielded and Open type Transformers available meets the requirements of every circuit. Write for list, etc.

MADE BY

OLIVER PELL CONTROL LTD
CAMBRIDGE ROW · WOOLWICH · S·E·18
Telephone: WOOLWICH 1422

CINTEL

The most comprehensive range of Cells in the world

TYPE VTA
FLAT
TRANSPARENT
CATHODE

'CINTEL' PHOTO-ELECTRIC CELLS

are manufactured with three different types of cathode surface as follows:—

TYPE 'A' — Antimony-Caesium (British Patent No. 522,752, **1938**) sensitive to daylight and blue light.

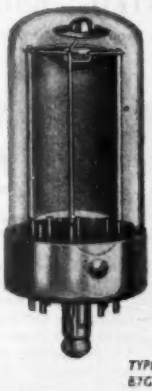
TYPE 'B' — Bismuth etc.-Caesium, sensitivity similar to that of the human eye.

TYPE 'S' — Silver-Oxygen-Caesium, sensitive to red-infra-red light.

There are over seventy different types covering every known application, and included in this range are:—

★Push-Pull types for double sound tracks. ★Special cells for dye image sound tracks. ★Cells of high insulation, linearity, and stability for accurate photometric work. ★Cells for use in the ultra violet region of the spectrum. ★Multiplier cells. ★Transparent cathode cells &c.

For further information, please write to:—



TYPE VS51
B8G BASE

TYPE VS50
B7G BASE

CINEMA-TELEVISION LIMITED

A Company within the J. Arthur Rank Organisation

FOREMOST IN THE MANUFACTURE OF

• Counters & Chronometers • Metal Detectors • Oscilloscopes • Photo-Electric Cells • Cathode Ray Tubes • Geiger-Muller Tubes • Electronic Instruments

WORSLEY BRIDGE ROAD · LONDON · S·E·26

Telephone: HITher Green 4600

SALES AND SERVICING AGENTS:

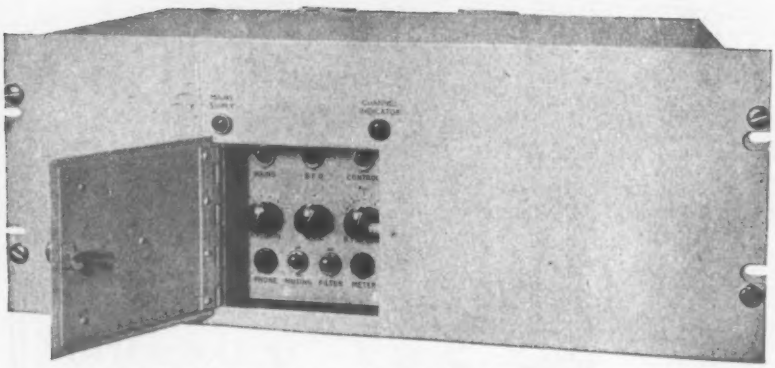
F. C. ROBINSON & PARTNERS LTD
287 Deansgate, Manchester 3

ATKINS, ROBERTSON & WHITEFORD LTD
100 Torrisdale Street, Glasgow S.2

H. HAWNT & CO. LTD
59 Moor St., Birmingham, 4

CINTEL

REGISTERED TRADE MARK



An Important Receiver...

. . in the extensive Redifon range of communications radio is the R.93—a fixed frequency, single channel receiver covering 2 to 20 Mc/s. Its crystal controlled oscillator and other special features make this the ideal unattended receiver for point-to-point and ground-to-air channels and it has full remote control facilities. Specialised applications of the R.93 include monitoring, diversity reception or frequency shift working.

The Redifon range includes MF, HF and VHF transmitters, receivers, radio telephones, navigational aids, AF amplifying systems and other electronic equipment. Enquiries for single units or complete networks including aerials, masts, power supply, land line amplifiers, remote controls and other apparatus are welcome.

AIRPORT Redifon Radio

Radio Communications Division

The R.93 is designed to the specification of International Aeradio Limited

REDIFON LIMITED, BROOMHILL ROAD, WANDSWORTH, S.W.18

DESIGNERS & MANUFACTURERS OF RADIO COMMUNICATION & INDUSTRIAL ELECTRONIC EQUIPMENT

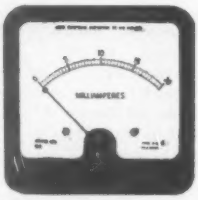
Phone: VANdyke 7281

Precision ELECTRICAL MEASURING INSTRUMENTS *by* **SIFAM**

ENGLAND

This Bench type portable instrument is used in many laboratories where consistent accuracy is demanded. Single or multi ranges for D.C. or A.C., calibrated to customers' requirements. Sizes 3½", 4" or 6" instruments. Accuracy B.S. First Grade.

The 4½" square type instrument is our new design embodying all the latest improvements. It has a large open scale so much desired for modern switchboard practice. The case is of black bakelite, and the instrument can be supplied in all ranges for D.C. It can be also fitted with a metal rectifier for A.C. working. Accuracy B.S. First Grade.



Prices on application.

PROMPT DELIVERY AND TWELVE MONTHS' GUARANTEE

SIFAM ELECTRICAL INSTRUMENT CO., LTD.,
LEIGH COURT - TORQUAY - *Telephone: TORQUAY 4547/8*

19263

BUILDING THE

"WILLIAMSON"?

if so, we have in stock all the specified components to make this superlative amplifier

Partridge Mains Output Transformers
Partridge Chokes
T.C.C. Condensers
High Stability Resistors, 1% & 5%
Precision Condensers, 1%, 2% & 5%
Matched valves
in fact "the works"

DETAILED PRICE LIST OF ALL COMPONENTS AVAILABLE ON REQUEST

TELE-RADIO (1943) LTD.

177, EDGWARE ROAD, LONDON, W.2

'Phone : PAD. 5606
PAD. 6116

Shop Hours:
Mon.-Sat. 9 a.m.—6 p.m.
Thursday 9 a.m.—1 p.m.

Manufacturers' Enquiries to :—
BRITISH ROLA
FERRY WORKS, SUMMER ROAD, THAMES DITTON, SURREY
(Emberbrook 3402-6)

Wholesale Enquiries to SOLE DISTRIBUTORS :
London and North : CYRIL FRENCH, LTD.
High Street, Hampton Wick, Middlesex (Kin. 2240)
South : ROBSHAW BROS.
105 Commercial Road, Bournemouth (Tel. 5896-7)

THE Simphonic TAPE RECORDER

MODEL 2B

- PORTABLE
- SELF CONTAINED
- EASY TO OPERATE
- HIGHLY EFFICIENT

Brief Specification :

WORKING VOLTAGE	—200/250 volts A.C. 50 c/s.
TAPE SPEEDS	—7½in. sec. and 12in. sec.
RUNNING TIMES	—30 minutes and 20 minutes.
REWIND	—Provision for fast rewind or forward running of complete spool in one minute.
ERASING	—Any recording may be erased. Erasure is automatic, preventing double exposure.
OUTPUT	—2 watts.
TERMINATIONS	—Inputs for microphone and radio and outlets for external speaker.
DIMENSIONS	—18½ x 13½ x 10in.
WEIGHT	—38 lb. complete.
ACCESSORIES	—Supplied complete with microphone, tape and spools.

See the 2B and our **NEW 1A MODEL** at the B.I.F. Stand C24/27Olympia

Simon SOUND SERVICE

Recorder House, 48-50 George Street, Portman Square, London, W.1, England

Telephone : Welbeck 2371 (4 lines) *Telegrams* : Simsale, Wesdo, London. *Cables* : Simsale, London

See what the latest plastics can mean in your business

BRITISH PLASTICS EXHIBITION

and Convention

Olympia London 6-16 June 1951

Every day industry is finding a thousand new uses for plastics products, which in many cases are replacing conventional materials in short supply. See what plastics can mean in YOUR business by visiting the first Exhibition and Convention of Britain's entire plastics industry. Many famous firms are participating in this all-embracing display—the finest of its kind ever staged. At the Convention, technical, applied and general aspects of the subject will be dealt with by international experts.

Organised by "BRITISH PLASTICS"—BRITAIN'S PREMIER PLASTICS JOURNAL

Britain's Entire Plastics Industry on Show for the First Time

MAIL NOW! —for colourful descriptive brochure

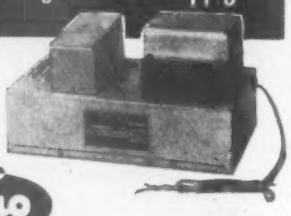
To BRITISH PLASTICS, Dorset House, Stamford Street, London, S.E.1.

Name ..... Address .....

Z.20

Exhibits include:—**Materials:** synthetic resins, moulding materials, laminates, sheeting, plasticizers and other essential ingredients; **Plant and Equipment:** injection and compression moulding presses, extrusion machines, moulds etc; **Manufactured Products:** technical and industrial components, consumer goods and finished products of many kinds. This is an exhibition you must not miss. Fill up the form for full details.

ALL the A.C. power you require from your D.C supply



with a

Valradio

D·C·/A·C· CONVERTER

Models for Electric Gramophones from £8, plus 10%

Models for
- Radio-grams and Autochange Radio-grams (inc. 3-speed motors)
- Radios
- Televisions, etc.,

from £10.15.0, plus 10%

Input, 6, 12, 24, 32, 50, 110 or 200/250V. D.C.
Output 230V. 50 or 60 c/s

Valradio *Descriptive literature W.W. 3 from the manufacturers:-*
57 FORTESS ROAD, LONDON, N.W.5
Telephone: GULliver 5165
Overseas Enquiries to nearest E.M.I. Organisation Depot

Widney-DORLEC
REGISTERED TRADE MARK

CABINET SYSTEM

Telescopic Mountings

See us at the
B.I.F., Birmingham
STAND C207
APRIL 30—MAY 11

Technical Adviser:
C. H. DAVIS
59, BROMPTON RD.
LONDON, S.W.3.

A Widney PRODUCT
WIDELY USED OVER THE WORLD
ESTABLISHED 1898

MANUFACTURERS
HALLAM, SLEIGH & CHESTON LTD
WIDNEY WORKS · BIRMINGHAM · 4

Phones: Aston Cross 0916 & 2020 • Grams: Superfine, Birmingham 4

GOODMANS
AUDIOM Loudspeakers

REGISTERED TRADE MARK

The unrivalled series of medium and heavy duty P.M. reproducers.

A BASS REFLEX CABINET
has been specially designed for use with the Audiom 60 and Audiom 70 reproducers. Working drawings are available.

Heavy duty multi-ratio transformer Model MR/T4

GOODMANS INDUSTRIES LIMITED
Lancelot Road, Wembley, Middlesex. *Telephone: Wembley 1200 (8 lines).* *Telegrams: Goodaxiom, Wembley*

Announcing . . . .

VISUAL A.F. WAVEFORM ANALYSIS

AUTOMATIC MEASUREMENT AND PANORAMIC PRESENTATION OF THE AUDIO FREQUENCY SPECTRUM

FEATURES

Frequency Range continuously variable from 40 to 1,000 cps and 40 to 20,000 cps.
Continuously scanned in 1 second.
Direct reading of voltage and frequency.
Automatic optimum frequency resolution.
Linear and log voltage calibration.
Built-in frequency calibrator.
Built-in stabilised power supply.
Screen—long persistence—providing a continuous overall view of the spectrum.
Portable.

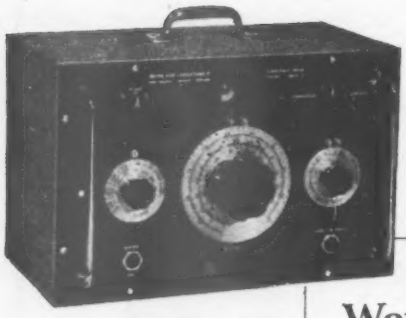
The Audio Frequency Visual Wave Analyser, Model 1950, provides a graphic presentation of an Audio Frequency Spectrum.

A unique circuit enables the frequency range of 40-20,000 cps to be scanned once per second without loss of frequency resolution. As the frequency components of any complex wave form are tuned through they are progressively displayed across the screen as a series of vertical pips.

The height of each pip indicates the magnitude of the harmonic in voltage or in decibels.

For further details write to :—

INDUSTRIAL ELECTRONICS
Makers of Industrial Controls and Precision Instruments
99, GRAYS INN ROAD, LONDON, W.C.1. *Phone: HOLborn 9873/4*



Component Bridge

Type B101

A general purpose component bridge providing facilities for measurements *in situ*. Operating frequency 50 cycles.

Capacity : 5 pfds.—500 mfds. in eight ranges
Resistance : 5 ohms—500 megohms in eight ranges
Inductance : 100 m/Hys.—5,000 Hys. in four ranges
Leakage : 0—1,500 microamps. Q : 0—30
General accuracy ± 2% Comparison Measurement ± .1%

Wayne Kerr

Inductance Meter Type M148-1

For direct reading measurement of inductance values between .05 Micro/Hys. and 100 m/Hys.—accuracy 2%.

A stable variable frequency oscillator (16 Kc/s.—5 Mc/s.) is used to resonate the unknown inductance with a fixed standard capacitor.

Provision is made for the measurement of small capacities and Q at resonance frequency.

THE WAYNE KERR LABORATORIES LTD. NEW MALDEN SURREY MALDEN 2202

THE NEW BRADMASTER MODEL 5 TAPE DESK *for* 1951

● Built to professional standards ● Two speeds—3¾ and 7½ inches per second ● Fast wind and rewind—full reel rewound in 1½ minutes ● Heavy alloy flywheel. Freedom from "wow" and "flutter" ● Double servo brakes on each hub ● Push Button control ● Three heavy duty motors ● Three shielded Bradmatic heads ● Size : 13½in. x 15½in. x 6½in. deep.

PRICE : £37.10.0

A PLUG BOX can also be fitted to the above equipment containing three compartments which provide shielding for the head leads and eliminating hum and cross talk. Also fitted with three coaxial plugs and sockets, facilitating connection of the desk to amplifiers, etc. **PRICE** (fitted underneath desk) **£1.5.0**

Hi-fidelity magnetic sound heads :	
type 5 R.P. (record play head)	£3. 5.0 each
type 5 E (erase head)	£3. 5.0 ,,
Super fidelity magnetic sound head, type 6 R.P. (record play head)	£3.15.0 ,,
Screening Cans, best quality (all mumetal)	8.0 ,,
composite (constructed of steel and mumetal)	4.6 ,,
Oscillator coils	8.0 ,,
Tape on 7in. reels, 1,200ft.	
Emitape, type 65	£1. 5.0
G.E.C. Grade "A"	£1.10.0
Durex type, MC I—III	£1.15.0

Trade supplied. Send for lists to sole Manufacturers :—

BRADMATIC LIMITED

STATION ROAD. ASTON, BIRMINGHAM, 6

Telephone: East 0674. *Telegrams:* Bradmatic, Birmingham

— towards perfection —

Most Trusted Name in Loudspeakers

LOWTHER P.M.2 drive unit for horn loading.

Only by the exacting skill of the craftsman in every stage of making, has the Lowther drive unit maintained its "second to none" reputation throughout the world.

The supreme performance in conjunction with either Lowther P.W.I corner cabinet or Voigt Reflector corner cabinet has yet to be surpassed!

Further details gladly sent upon request :—

THE LOWTHER MANUFACTURING CO.

(The Laboratory Production unit)

LOWTHER HOUSE, ST. MARK'S ROAD., BROMLEY, KENT. Phone RAV. 5225

ELECTRONICS CENTRE of the NORTH

R P

Electronic Batch Counting Equipment installed on Cylindrical Paper Ruling Machine with Special Marking Device.

- **DISTRIBUTION** Suppliers and Stockists of all types of Electronic Instruments and equipment.
- **COMPLETE INSTALLATIONS ENGINEERED.** Metal Detection. Batch Counting. Electro-chemical Controls. Radiation Thickness Measurement.
- **DESIGN of ANCILLARY EQUIPMENT**
- **MAINTENANCE & SERVICE**

AGENTS FOR

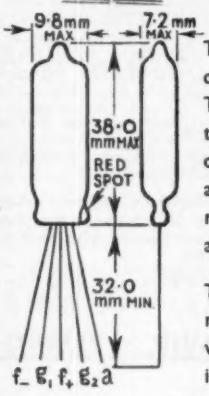
CINEMA-TELEVISION LTD.
MULLARD ELECTRONIC PRODUCTS LTD.
BALDWIN INSTRUMENTS.
KELVIN & HUGHES STRAIN AND PEN RECORDERS.
COSSOR OSCILLOSCOPES.
FURZEHILL LABORATORIES.
WAYNE KERR LABORATORIES, and all leading manufacturers of electronic instruments

Write us to add your name to our mailing list for regular information on new instruments and development.

F. C. ROBINSON & PARTNERS LTD
287 DEANSGATE MANCHESTER
DEAnsgate 6601

Beam Tetrode Subminiature Output Valve

XFY23



The very high efficiency of the XFY23 Beam Tetrode makes it particularly suitable for the output stages of hearing aids where the requirement is for large output at low values of H.T.

The XFY23 has, however, many other applications where small size, efficiency and economy are needed.

TYPICAL OPERATION

Filament Voltage	.. .. ..		*1.25V*
Filament Current	.. .. ..		*17½mA*
Anode Voltage	.. .. ..	*15V*	*22½V*
Mean Anode Current	.. ..	*200μA*	*400μA*
Optimum Load	.. .. ..	*75KΩ*	*50KΩ*
Power Output	.. ..	*1.0mW*	*3.75mW*

HIVAC
THE SCIENTIFIC VALVE
BRITISH MADE

GREENHILL CRESCENT
HARROW-ON-THE-HILL, MIDDLESEX
Telephone : HARrow 2655

At the Festival of Britain

Specially selected for the Festival of Britain is the AMBASSADOR T.V.4. Corner Console. It will be on show in the Homes and Gardens section as well as the Land Travel Exhibition.

Its unique styling presents the most pleasing appearance of any television receiver. Fitting into the corner of a room, it takes up the least possible space and provides easy viewing for your family and friends on its full sized 12" aluminised screen.

Obtainable only from your AMBASSADOR agent— Cash Price **£78**

Literature gladly sent on request to

AMBASSADOR RADIO - PRINCESS WORKS - BRIGHOUSE - YORKSHIRE

RQ10

Drayton
MOTOR UNITS

for

The Drayton R.Q. is a miniature capacitor induction type motor with a current consumption at 230 volts 50 cycles of 0·09 amps pf. 0·9. *It is available:*

R.Q.G. GEARLESS for running at 2700 r.p.m. continuously or intermittently in either direction or continuously reversed.

R.Q.R. GEARED for continuous running or reversing at speeds from 27 mins. per rev. to 600 revs. per min.

R.Q.H. GEARED for high final shaft speeds for continuous running, forward or reverse.

Send for List No. N.302-1

actuating valves, dampers, rheostats, geneva movements, rocking baths, flashing signs, illuminated models, soldering and welding fixtures, rotating tables, automatic light strip feed, lubricating and other small pumps, small machines, animated displays, vibrators, developing baths, agitators, fans, aspirators and similar devices.

Drayton Regulator & Instrument Co. Ltd., West Drayton, Mdx. W. Drayton 2611

They're all different . .

despite an outward uniformity, you know they are not *exactly* the same. Similarly with tuning coils and I.F. transformers, there are bound to be small variations. If they are E.T.A. components, however, you can be certain that they vary only within very fine limits, whether the quantity is a hundred or a hundred thousand, and that's saying a lot! Get into touch with E.T.A. about your requirements—you're likely to be pleasantly surprised.

E T A

ELECTRO TECHNICAL ASSEMBLIES

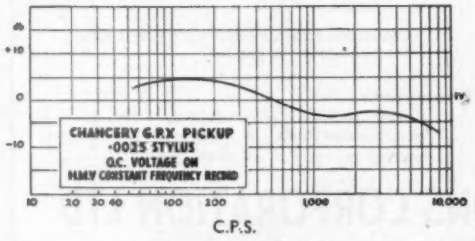
WEST HILL · ST. LEONARDS-ON-SEA

'Phone: Hastings 471

A NEW PICK-UP FOR LONG PLAYING & STANDARD RECORDS

ANNOUNCING THE CHANCERY G.P.X. LIGHTWEIGHT CRYSTAL PICK-UP WITH INTERCHANGEABLE MICROCELL CARTRIDGE HEAD.

A Chancery INSTRUMENT



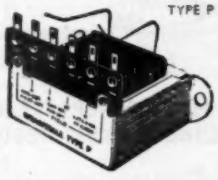
For the discriminating enthusiast, this pick-up has been designed to give a standard of performance not possible with normal magnetic or crystal pick-ups.
Its wide range of frequency response can be seen from the graph shown here.
Special features are the high output and low distortion figures, light-weight balanced arm, semi-permanent sapphire stylus and the easy change-over of cartridges from long playing to standard or vice-versa.
Characteristics of the microcell crystal cartridge facilitate the matching to the average radio receiver or amplifier.

Prices of the Chancery G.P.X. Pick-up (including Purchase Tax):
With either Long Playing or Standard Cartridge £2.13.0
With one Long Playing and one Standard Cartridge £4.4.6

Fuller particulars on receipt of stamped addressed envelope, from:

CHANCERY PRECISION INSTRUMENT SERVICE LTD.
Sales Department: 64, GEORGE STREET, BAKER STREET, LONDON, W.1

Wharfedale
OUTPUT TRANSFORMERS



Wharfedale transformers have been in steady demand since their introduction 15 years ago, and have built up a high reputation for reliability. Returns from all causes are less than ½%.

LIST PRICES:

O.P.3 ... 3 ratios ... 7/-		De Luxe ... 6 ratios ... 25/-	
P. Type 4 ratios ... 8/-		W. 12 ... 3 ratios ... 23/6	
G.P.8 ... 8 ratios ... 12/6		W.12 Ratios to order ... 27/6	
Universal 6 ratios ... 15/-		W. 15 Ratios to order ... 65/-	

TWO PRACTICAL GUIDES TO GOOD REPRODUCTION

AUTHORITATIVE · DOCUMENTED · ILLUSTRATED

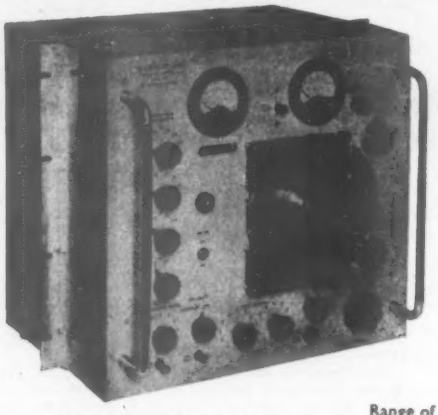
LOUDSPEAKERS
By G. A. BRIGGS
The Why and How of Good Reproduction
3rd Edition (5th Impression)

A standard reference book, written in the author's attractive style, it answers the numerous questions that arise in connection with the reproduction of sound via the Loudspeaker.
88 pages, 35 illustrations 5/- (5/3 post free)
Enjoyment of these books is enhanced by the occasional flashes of humour now expected from Mr. Briggs.

SOUND REPRODUCTION
By G. A. BRIGGS

Indispensable, both to the expert and to the amateur enthusiast, the second edition of this authoritative work provides full information and detailed guidance on a variety of subjects ranging from cabinet design to needles and grooves.
248 pages, 193 diagrams.
Bound Full Rexine 10/6 (11/- post free)
De Luxe Library Edition handsomely bound in real leather 17/6 (18/3 post free)

WHARFEDALE WIRELESS WORKS · BRADFORD ROAD · IDLE · BRADFORD · YORKS
Telephone: Idle 461



SELECTIVE

TRANSMISSION MEASURING SET

MODEL RP 3110

Designed and Manufactured for G.P.O.

This is a precision instrument for measurements on multi-circuit coaxial cable carrier systems by means of a comparison with locally generated signals of known frequency and level.

Frequency coverage : 60 Kc/s — 3 Mc/s in 7 ranges.

Calibration accuracy : below 0·2% or 2 Kc/s whichever is the greater.

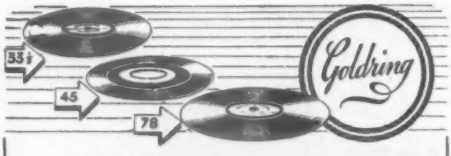
Power supplies :
200 — 250 Volt, 50 c/s

Range of measurements :
through levels + 10 db to - 61·5 db
or terminated levels + 10 db to - 81·5 db
referred to 1mW in 75 ohms

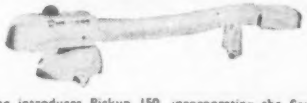
BRITISH COMMUNICATIONS CORPORATION LTD.

GORDON AVENUE, STANMORE, MIDDX.

Telephone : GRIMSDYKE 2266. Cables : DISC, STANMORE.



3 WAY PICK-UP FOR STANDARD AND LONG PLAYING RECORDS



Goldring introduces Pickup 150, incorporating the first British **Magnetic** Cartridge. Cartridge 150X available separately. The movement of this Cartridge is of balanced armature construction, and combines high output with wide frequency range and exceptionally low tracing distortion. Needle armature is easily replaceable by user.

Data	78 r.p.m.	45 and 33⅓ r.p.m.
Armature resonance	16 kc/s	9 kc/s
Output	70 mV	Equivalent to 150 mV on 78 r.p.m.
Tracking weight ...	15-20 grms.	7 grms
Load	30 kΩ	30 kΩ
Stylus	.003 code blue	.001 code yellow

Comprehensive information service on circuitry available to users

Write for full technical information to :—

ERWIN SCHARF

49-51a, DE BEAUVOIR ROAD, N.1

Telephone : CLissold 3434

LOUDSPEAKER CABINETS

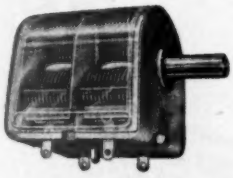
We manufacture a comprehensive range of attractively designed and well-finished loudspeaker cabinets, suitable for housing the majority of high-fidelity loudspeakers. In addition to this standard range of cabinets, we specialise in supplying cabinets to customers' individual requirements, including console and radiogram types, and can submit a quotation on receipt of a sketch and description of the cabinet required. An illustrated brochure dealing with our range of loudspeaker cabinets is available on request. In addition leaflets dealing with the following are available: amplifiers, preamplifiers, radio units, and recommended high-fidelity loudspeakers and pick-ups.

ROGERS DEVELOPMENTS CO.

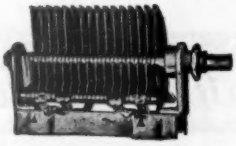
"Rodevco House," 116, Blackheath Road, GREENWICH, S.E.10.

Telephone : TIDeway 1723

SO SMALL— IT DOES A BIG JOB



Miniature in Size, but big in performance. *The M.M. 2 Gang Condenser* has frame dimensions of only $1\frac{7}{16}$" x $1\frac{19}{32}$" x $1\frac{11}{16}$". Complete with dust cover. Cat. No. 4702. PRICE 10/6



TYPE 604 (illustrated) is a low-loss short-wave condenser suitable for Chassis or one-hole fixing. Brass vanes are soldered to supports and electroplated.

TYPE 603 is a split stator condenser of similar construction.

The S.1 series in both types are particularly suitable for low power transmitters.

PRICES: Type 604 .. 15/3—17/0
Type 603 .. 16/0—17/6

Replacement Scales calibrated to Copenhagen Plan now available for :—

Airplane Drive ..	.. ..	2/3 *retail*
Squareplane Drive	.. ..	2/6 *retail*
Full Vision Drive	.. ..	2/9 *retail*
S.L.8 or S.L.5 Drive	.. ..	4/6 *retail*

PRECISION COMPONENTS BY

JACKSON

BROS (LONDON) LIMITED

KINGSWAY · WADDON · SURREY

Tel. : Croydon 2754-5 Grams : Walfilco, Sauphone, London

Estd. **L·R·S** 1925

For PROMPT and EFFICIENT SERVICE

CASH or EASY TERMS

ARMSTRONG ALL-WAVE CHASSIS

(including speaker and output transformer)

MODEL EXP 83/3. Cash £18/17/1 or £8/0/0 with order and 6 monthly instalments of 40/-.

Passenger train 10/- extra.

CONNOISSEUR 2-SPEED GRAM-MOTOR

Three only for immediate delivery. Price £20 . 19 . 3

Passenger train 3/- extra.

GOODSELL AMPLIFIERS & TUNERS

The new range of High-grade Units is now available on Our Easy Terms.

THE BEST SHAVE OF ALL

IS WITH THE

REMINGTON-RAND ELECTRIC SHAVER

It really does give a better, more pleasant and quicker shave than the blade and soap method.

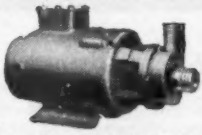
We are so convinced you will agree, that we shall be pleased to send either model on **TEN DAYS' FREE TRIAL** on receipt of deposit.

THE 'FOURSOME' (for average beards). Cash £7/16/5 or 30/- with order and 7 monthly instalments of 20/-.

THE 'FIVE' (for stubborn beards). Cash £8/17/7 or 50/- with order and 7 monthly instalments of 20/-.

Both models supplied in beautiful silk-lined case. Prompt despatch per registered post. Write for the free Remington Brochure.

STUART HIGH GRADE ELECTRIC CENTRIFUGAL PUMPS



For all pumping purposes

No. 10 ..... £8 . 0 . 0
No. 12 .....£11 . 5 . 0
No. 21 .....£23 . 0 . 0

Including large foot valve and strainer. Carriage paid.
Full specification on request.

All goods despatched carriage paid.
Descriptive literature available on request.
Kindly enclose Stamp.

The L.R. SUPPLY COMPANY LTD.
(LONDON RADIO SUPPLY CO.),
BALCOMBE - - SUSSEX

GARDNERS RADIO Ltd

SOMERFORD CHRISTCHURCH HANTS
Tel.: Christchurch 1025

TRANSFORMERS FOR THE RADIO, TELEVISION AND ELECTRONIC INDUSTRIES

GR

Used wherever Quality is called for

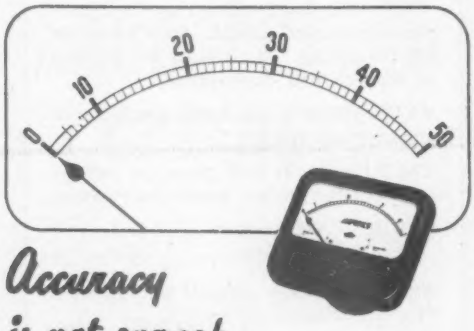
Idealism

Concepts may be divided into 3 categories—from the lowest to the highest—Concrete, Functional and Abstract.

Designs and policies may also have similar propensities. In a sadly materialistic world, our products are the result of an unshakable belief that progress is *earned* by the pursuit of things as they should be and is not the fruit of the limitations of things as they are.

Our wish for 1951 is that the number of those sharing our belief will increase.

J. H. BRIERLEY (Gramophones & Recordings) LTD.
KIRKBY TRADING ESTATE, LIVERPOOL



Accuracy is not enough

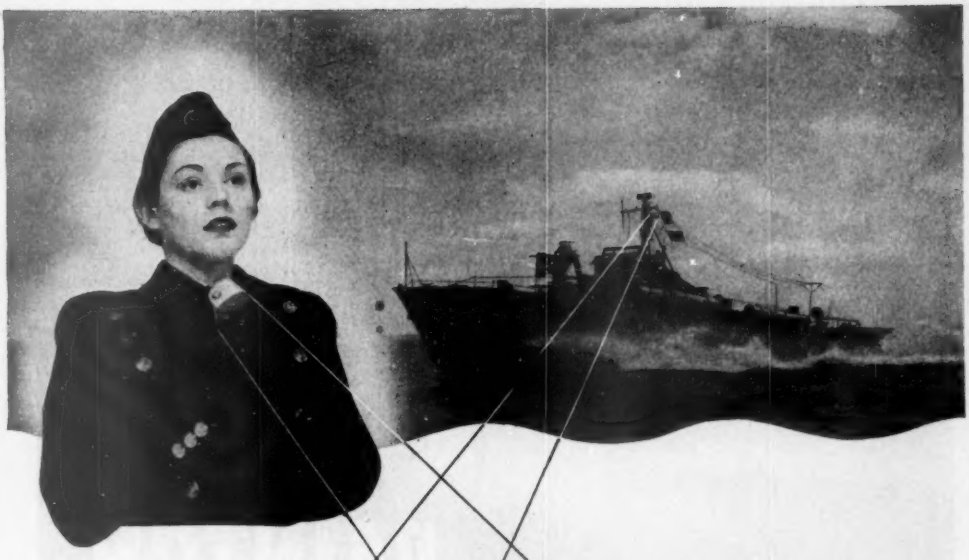
The most accurate measuring instruments in the World are only of use if they can be read easily. A feature of the range of Pullin Rectangular instruments is the extreme legibility of their scales.

Available in all the standard ranges in sizes 3", 3½" and 6". Let us know your requirements and we shall be pleased to make recommendations regarding suitable instruments.

PULLIN *RECTANGULAR INSTRUMENTS*

MIP MEASURING INSTRUMENTS (PULLIN) LIMITED

Electrin Works, Winchester St., W.3. Phone: ACOrn 4651



Where important things happen you'll find VITAVOX

In ships of the Royal Navy and the Mercantile Marine, at Airports, in Broadcasting Stations, in Film Studios . . . in fact in all places where sound is important you'll find VITAVOX Loudspeakers and Microphones. It almost tempts us to say that what's good enough for them is good enough for you ! Anyway, it's worth while for you to find out whether VITAVOX Sound Equipment will meet your requirements, and although deliveries are once again subject to delay because of the prior claims of the Services, we'll gladly send you full information on request.

Type BP.—Beam Projector Horn

VITAVOX

LOUDSPEAKERS

MICROPHONES

Series B.50 Microphone

VITAVOX LIMITED, WESTMORELAND ROAD, LONDON, N.W.9, ENGLAND. TELEPHONE: COLINDALE 8671 (PBX). TELEGRAMS: VITAVOX, HYDE, LONDON. CABLES: VITAVOX, LONDON, ENGLAND.

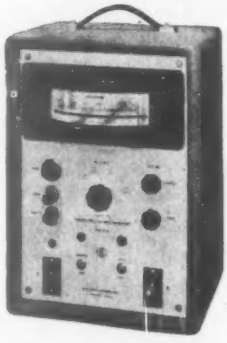
C 1 C

SPRING LOADED TERMINALS
by
A Positive CONNECTION WITHOUT SOLDER · SIMPLY PRESS & RELEASE
PAINTON
PAINTON & CO LTD · KINGSTHORPE · NORTHAMPTON · ENGLAND

Instruments for Research and Industry

The TWENTY MILLION MEGOHMMETER

The modern instrument for the measurement of resistance. Covers the range from 0.3 to 20,000,000 megohms in six decades. Two test voltages, 85v and 500v are provided and a six-inch mirror scale meter enables readings to be taken accurately and quickly. The instrument is especially useful for testing cables, resistors, condensers and all insulating materials.



ELECTRONIC INSTRUMENTS LTD
17, PARADISE ROAD RICHMOND SURREY ENGLAND

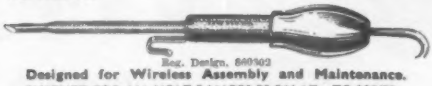
THE *Fidelia* LUXURY 7-VALVE RADIOGRAM CHASSIS

Features include variable selectivity, infinite impedance detector, electronic bass and treble controls, triode output stage; 3 wavebands 16-50, 190-550 and 1,000-2,000 metres. Audio amplifier response 30-18,000 cycles; bass, treble and volume controls operate on gramo., suitable for light weight p.u. Guaranteed 12 months. Price £18/5/0

Data Sheets on request, also for "Preciton" 5-valve chassis, £12/17/6 and 9-valve De Luxe chassis at £21/5/0.

ELECTRO *Acoustic* DEVELOPMENTS
18 BROAD RD., WILLINGDON, SX.

"ADCOLA" SOLDERING INSTRUMENTS
Reg. Trade Mark



Reg. Design. 840302

Designed for Wireless Assembly and Maintenance.
SUPPLIED FOR ALL VOLT RANGES FROM 6/7v. TO 230/50v.
The three Adcola Models cover the requirements of the **Television, Telecommunication and Radar Engineers** and assure thorough jointing.
1/4in. dia. Bit. Standard Model— 22/6
5/16in. dia Bit. Standard Model— 25/-
3/8in. dia. Detachable Bit — — 30/-
Patented in England and Abroad.
Sole Manufacturers :
ADCOLA PRODUCTS LIMITED
Sales and Service: 50, CLAPHAM HIGH STREET, LONDON, S.W.4
Tele. : MACaulay 4272.

The New

MAGNAVISTA

Filtachromatic Television Lens

The CENTRE of interest!

The filter is actually *inside* the lens —this allows daylight viewing with a normal brilliance setting and avoids overworking the tube.

Add to this unique feature the other exclusive Magnavista advantages, and you have a lens which has brought greater television enjoyment to thousands of viewers.

There is a Magnavista model specially computed for every set.

PRICES :

There are over 18 different Magnavista models at prices ranging from £4 . 14 . 6 to £7 . 17 . 6.

a product of

METROPEX LTD

38 GREAT PORTLAND ST., LONDON, W.1

MAINS TRANSFORMERS, FULLY INTERLEAVED, SCREENED AND IMPREGNATED. ALL GUARANTEED. ALL PRIMARIES ARE 200/250 v. Half Shrouded.

HSM63. (Midget). Output 250–0–250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. 18/–
HS63. Output 250–0–250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. 18/6
HS40. Windings as above. 4 v. at 4 amps , 4 v. at 2 amps 18/6
Output
HS2. 250–0–250 v. 80 m/a. 21/–
HS30. 300–0–300v. 80 m/a. 21/–
HS3. 350–0–350 v. 80 m/a. 21/–
HS2X. 250–0–250 v. 100 m/a. 23/–
HS75. 275–0–275 v. 100 m/a. 23/–
HS30X. 300–0–300 v. 100 m/a. 23/–
HS3X. 350–0–350 v 100 m/a. 23/–

Fully Shrouded

FSM63. (Midget). Output 250–0–250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. 18/6
Output
FS2. 250–0–250 v. 80 m/a. 23/–
FS30. 300–0–300 v. 80 m/a. 23/–
FS3. 350–0–350 v. 80 m/a. 23/–
FS2X. 250–0–250 v. 100 m/a. 25/9
FS75. 275–0–275 v. 100 m/a. 25/9
FS30X. 300–0–300 v. 100 m/a. 25/9
FS1X. 350–0–350 v. 100 m/a. 25/9
All the above have 6.3–4–0 v. at 4 amps., 5–4–0 v. at 2 amps
FS43. Output 425–0–425 v. 200 m/a., 6.3 v. 4 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded 51/–
FS50. Output, 450–0–450 v. 250 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded 75/–
F30X. Output 300–0–300 v. 80 m/a., 6.3 v. 7 amps , 5 v. 2 amps. Framed. Flying leads 31/9
F35X. Output, 350–0–350 v. 250 m/a., 6.3 v. 6 amps, 4 v 8 amps., 4 v. 3 amps., 0–2–6.3 v. 2 amps. Fully shrouded 71/6
FS160X. Output 350–0–350 v. 160 m/a., 6.3 v. 6 amps , 6.3 v. 3 amps., 5 v 3 amps. Fully shrouded 45/–
FS43X. Output, 425–0–425 v. 250 m/a., 6.3 v. 6 amps., 6.3 v. 6 amps., 5 v. 3 amps. Fully shrouded 69/–
HS6. Output, 250–0–250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. For receiver R1355. Half shrouded 29/3
HS150. Output, 350–0–350 v 150 m/a., 6.3 v 3 amps., C.T. 5 v. 3 amps. Half shrouded 30/9
F36. Output, 250–0–250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. Half shrouded 30/9
FS120. Output, 350–0–350 v. 120 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 2 amps., C.T. 5 v. 3 amps. Fully shrouded 33/–
FS256. Output 250–0–250 v. 80 m/a., 6.3 v. at 6 amps., 5 v. at 3 amps. Fully shrouded 30/9
PRI/1. Output 230 v. at 30 m/a., 6.3 v at 1.5/2 amps. 23/–
FS150. 350–0–350 v. 150 m/a., 6.3 v. 4 amps., 5 v. 3 amps. 34/9
The above have inputs of 200/250 v.

FILAMENT TRANSFORMERS

F4. Output, 4 v. 2 amps 9/–
F6. Output, 6.3 v. 2 amps 9/–
F6X. Output, 6.3 v 0.3 amps 6/–
F12X. Output, 12 v. at 1 amp. 9/–
F12. Output, 12.6 v. tapped 6.3 v. at 3 amps. 18/6
F24. Output, 24 v. tapped 12 v. at 3 amps. 26/–
F12 and F24 framed with Flying Leads.
FU6. Output, 0–2–4–5–6.3 v. at 2 amps. 11/–
F29. Output, 0–2–4–5–6.3 v. at 4 amps. 20/9
FU6 and F29 clamped with Flying Leads.
FS. Output, 6.3 v. at 10 amps. or 5 v. at 10 amps or 12.6 v. at 5 amps. or 10 v. at 5 amps. 37/9
F64. Output, four at 6.3 v. tapped at 5 v. at 5 amps. per winding, giving by suitable series and parallel connections 24 v. at 5 amps., 20 v., at 5 amps., 18 v. at 5 amps., 15 v at 5 amps., 12.6 v. at 10 amps., 10 v. at 10 amps., 6.3 v at 20 amps , 5 v. at 20 amps 57/–
F5 and F6/4 framed with flying Leads.
FU12. Output 0–4–6.3 v 3 amps. 19/6
FU24. Output 0–12–24 v. 1 amp. 19/6
The above have inputs of 200/250 v

OUTPUT TRANSFORMERS

MOP1. Ratios 26, 46, 56, 66, 90, 120–1 50 m/a. max. current. C.T for Q.P.P. Class B, etc. Secondary 2/4 ohms. Top panel and clamped, each 6/–
OP1. Midget Power Pentode, ratios 30, 60, 90–1, 40 m/a , Secondary 2/3 ohms, each 4/–
OP2. Midget Pentode, ratios 45–1, Secondary 2/3 ohms, 40 m/a. per doz 39/6
OP10. 10/15 watts output. 20 ratios on Full and Half primary ... 19/9
OP30. 30 watts output, 20 ratios on Full and Half primary 28/6
Williamson's O.P. Transformer to Author's specification £4/3/6
Chokes for Williamson's Amplifier. 30H at 20 m/a. 15/6
10H at 150 m.a. 35/6
Choke C4. 60 m/a., approx. 8 H.. 350 ohms. 5/–
Choke C5. 40 m/a., approx. 5 H., 360 ohms 4/–
Choke C6. 50 m/a., 50 H. 1,500 ohms. 22/–
C7. 90 m/a., 180 ohms, clamped 6/3
C8. 360 Micro henries clamped 5/3
Belling Lee Co-Axial Plugs. Type 642/P., each 1/3
Belling Lee Co-Axial Sockets. Type 604/S, each 1/3
B.I. Condensers, all new. 8 mfd. carton type, 3/2 ea.; 8 x 8 mfd carton type, 4/9 ea. ; 8 x 8 mfd., can type, 5/– ea. ; clips for same each 5d.
C.W.O. (add 1/- in £ for carriage), all orders over £2 carriage paid. Trade enquiries invited.

H. ASHWORTH (Dept. W.W.),
676, Gt. Horton Road, Bradford, Yorks.

Measurements can be made from
1mV to 100V with the Furzehill
SENSITIVE VALVE VOLTMETER
over the range **10c/s to 500 Kc/s.**
Logarithmic scale shape and
high input impedance are
other features.

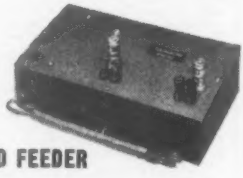
by Furzehill

FURZEHILL LABORATORIES LIMITED
Boreham Wood, Herts. Tel. : ELStree 3940

RAINBOW radio & television

TV PRE-AMPLIFIER

PRICE £5.17.6 SUBJECT



FOR USE WITH CO-AXIAL or BALANCED FEEDER

Built-in Power Pack, Metal Rectifier, EF91 Valve. Still further improved in performance and with new ventilated case, $8\frac{3}{8}'' \times 4\frac{3}{4}'' \times 2\frac{1}{8}''$.

2-VALVE MODEL FOR EXTREME FRINGE AREAS

£7.10.0 (Subject)

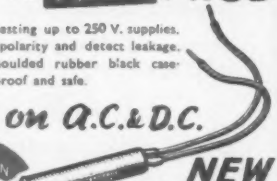
Available for Alexandra Palace, Sutton Coldfield, and soon for Holme Moss.

RAINBOW RADIO MNFTG. CO. LTD.
MINCING LANE : BLACKBURN : LANCS.

NEON TEST PROD

Suitable for testing up to 250 V. supplies. Will indicate polarity and detect leakage. Housed in moulded rubber black case. Totally shockproof and safe.

Tests on A.C. & D.C.



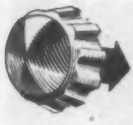
FOR EVERY SERVICEMAN
PRICE 10/- RETAIL
NEW
A.F. BULGIN & CO., LTD.
BYEPASS RD., BARKING, ESSEX

CQ CQ CQ CQ CQ CQ

CALLING ALL EX-MERCHANT NAVY RADIO OFFICERS. CONVERT THAT SPECIAL CERTIFICATE TO A 1st or 2nd CLASS CERTIFICATE

AT

THE WIRELESS TELEGRAPH COLLEGE
25, John Dalton Street, Manchester 2
SPECIAL SUMMER EVENING COURSES COMMENCING JUNE 1st, TO OCT. 31st



STUDIOS
AERIALS
CAMERAS
TRANSMITTERS
LINKS

Industrial Television. The televising of recent High Voltage electrical experiments at the Nelson Research Laboratories, Stafford.

MARCONI television

Made by MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX
—the only British firm to make complete equipment for television transmission

G.E.C. QUARTZ CRYSTAL UNITS

For Reliable Radio Communications

From take-off to landing, the safety of passengers, cargo, and machines is largely dependent on trouble-free radio communication.

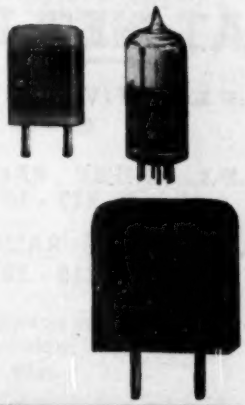
Weather reports, conditions at terminal airports, etc., must be reported to aircrews.

Navigation by radio beacons plays an important part in keeping the planes flying safely on their assigned routes.

Be sure, then, that the Quartz Crystal Units in your radio equipment are the best obtainable, for they are the most critical components.

Pioneering research and experience in making over a million units, ensure a product of the finest available quality at competitive prices. We can give rapid delivery for your urgent requirements.

When the requirement is exceptionally urgent, phone Middleton (Lancs.) 2424 or Temple Bar 4069 (London).



SALFORD ELECTRICAL INSTRUMENTS LTD. PEEL WORKS · SILK ST. SALFORD 3 · LANCS.

A Subsidiary of THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

Ceramic stand-off Insulators

by

U.I.C

UNITED INSULATOR CO. LTD. OAKCROFT RD. TOLWORTH · SURBITON · SURREY

TELEPHONE ELMBRIDGE 5241 CABLES CALANEL SURBITON

B.P.L. TEST SETS

NOW AVAILABLE

AT NET PRICES

B.P.L. UNIVERSAL TEST SET
£5 - 18 - 6

B.P.L. SUPER RANGER 1,000 Ω/v.
£13 - 10 - 0

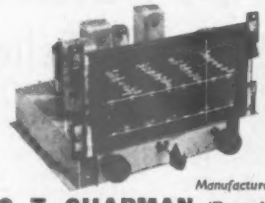
B.P.L. SUPER RANGER 20,000 Ωv.
£15 - 10 - 0

Prices include postage and packing and are applicable to Home Market only.

Send your order direct to:

BRITISH PHYSICAL LABORATORIES
HOUSEBOAT WORKS, RADLETT, HERTS
Tel.: Radlett 5674-5-6

TUNERS



Our Type 84 is the ideal Quality Tuner for your high quality amplifier. This four valve Super-Het Unit has a lively performance with very low distortion. Fitted variable selectivity 7K.C. and 10K.C. Wave-band coverage 16-50m., 195-550m., 900-2,000m. Using latest Mullard valves ECH42, 2xEF41, EB91.

PRICE £12
+ £2 . 13 . 4 P.T.

Manufacturers of Ventax Cabinets.

C. T. CHAPMAN (Reproducers) Ltd. FLA-man 3217
RILEY WORKS, RILEY STREET, CHELSEA, S.W.10
Daily Demonstrations at Webb's Radio

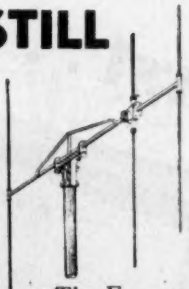
COILS • COILS • COILS

T.R.F. • SUPERHET • FILTERS • PACKS
TELEVISION COILS • I.F. TRANSFORMERS

FOR DEPENDABLE COMPONENTS CONTACT

OLYMPIC RADIO COMPONENTS
COIL WINDING SPECIALISTS & MANUFACTURERS
224, HORNSEY RD., N.7. NORTH 2914

and... it is STILL THE BEST LONG-DISTANCE AERIAL!



The Famous
FA 22

The FA22 maintains its superiority. Quite apart from its proven high sensitivity, its very sturdiness raises it well above any other TV aerial. Designed by engineers, its scientific construction enables it to withstand the rigours of the most exposed positions. A Seamless Steel Spreader, adjustable Steel Mast-head Clamp to fit masts from 1¼in. to 3in. dia., Shock Absorber Reflector Mountings, and the general overall weatherproof method of construction ensures this unrivalled strength and durability.

£5.12.6 Complete. All Channels.

GUARANTEED FOR TWO YEARS

BUT.....
HERE IS ANOTHER

TELECRAFT **TRIUMPH**
The **TS 25**

Especially designed for the less remote areas, this aerial is of the same sturdiness of design as the FA22. It retains the well-known TELECRAFT Dipole Feeder Box, Collectors and Reflectors. It has an adjustable Steel Mast-head Clamp to fit masts from 1¼in. to 3in. dia., and the Reflector is fitted with the TELECRAFT Shock Absorber Mounting. A .25 wavelength Seamless Steel Spreader completes this fine Aerial.

PRICE **£2.17.6** All Channels.

Remember! Because of their fine construction TELECRAFT AERIALS ARE BETTER THAN ANY and CHEAPER THAN MOST.

All Stove Enamelled Throughout.

Contact your Wholesaler and insist on TELECRAFT LIMITED *Send for Descriptive Literature*

QUADRANT ROAD : THORNTON HEATH SURREY

Tel.: THOrnton Heath 1191/2/3

Depots:—BIRMINGHAM, BRISTOL, MANCHESTER, WORTHING, STOKE-ON-TRENT.

SCOTTISH ENQUIRIES: LOUIS GRACE, 28, Langside Place, Glasgow, S.1.

Quelle horreur!

What can be more shattering to constructive thought than an imaginary man with a drill in your head? Only a real man with a road drill by your window. But these 'Commandos of the Highway Dept.' do get things done more quickly.

Probably on the circuit that makes the darned thing 'pop' is a Transformer, maybe a Parmeko Transformer, doing its work with silent efficiency.

PARMEKO *of* **LEICESTER**

Makers of Transformers for the Electronic and Electrical Industries

Hear these amplifiers first . . .

PORTABLE BATTERY MAINS BM40

An attractive appearance and unique construction combined with first-rate performance give this instrument the hallmark of distinction. Peak power 40 watts, 30 watts undistorted. Designed for both A.C. Mains and 12-volt battery operation. Provision for independent electronic mixing of two microphones and one gramophone channel. Built-in vibrator. Special tone control circuit, with independent bass boost and cut, and treble boost and cut.
These and many other features make the BM40 the most up-to-date amplifier available.
List price £50.

MOBILE CAMPAIGN OUTFIT MA15

An ideal equipment for mobile applications, giving crisp, clear messages. The outfit comprises: 15 watt amplifier for either 6 volts or 12 volts operation; hand microphone type M.C.B., and co-axial weatherproof loudspeaker. A gramophone input and battery-saver switch are incorporated.
List price £48 10s.

30 WATT PORTABLE PA30/B

A 30 watt amplifier for public address men. Inputs for moving coil or ribbon microphones and gramophone. Tone control. Illuminated panel and output signal level indicator. Outputs: 7.5, 15 ohms and 100 volt line. Operates from 200/250 volts A.C. mains, or 12-volt battery when used with battery adaptor unit type LT30. An ideal equipment for P.A. vans, general installations and outdoor requirements. Supplied in a handsome portable case.
List price: PA30/B Amplifier, £40.
LT30 Battery Adaptor, £12 10s.

BIRMINGHAM SOUND REPRODUCERS LIMITED
CLAREMONT WORKS, OLD HILL, STAFFS. TEL.: CRADLEY HEATH 62123

Wireless World

RADIO, TELEVISION AND ELECTRONICS

41st YEAR OF PUBLICATION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
Editor: H. F. SMITH

MAY 1951

In This Issue

EDITORIAL COMMENT 167

INDOOR TELEVISION AERIAL. By *H. Page* 168

DIODE DETECTOR DISTORTION. By *W. T. Cocking* .. 171

FESTIVAL OF BRITAIN 173

SENSITIVE NULL DETECTOR. By *M. G. Scroggie* 175

LETTERS TO THE EDITOR 179

JOINTING ALUMINIUM 181

WORLD OF WIRELESS 182

TRENDS IN COMPONENTS 185

PHYSICAL SOCIETY'S EXHIBITION 189

FREQUENCY MODULATION. By "*Cathode Ray*" 193

THE 1,000-LINE WILL O' THE WISP. By *R. W. Hallows* .. 197

RADIO ON THE AIRWAYS 199

TEST REPORT: R.G.D. TELEVISION RECEIVER .. 203

SHORT-WAVE CONDITIONS. By *T. W. Bennington* 205

RANDOM RADIATIONS. By "*Diallist*" 206

UNBIASED. By "*Free Grid*" 208

PUBLISHED MONTHLY: Price 2/- (last Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. *Telephone:* Waterloo 3333 (60 lines). *Telegrams:* "Ethaworld Sedist, London." *Annual Subscription:* Home and Overseas, £1 7s. 0d. U.S.A. $4.50, Canada $4.00. BRANCH OFFICES: *Birmingham:* King Edward House, New Street, 2. *Coventry:* 8-10, Corporation Street. *Glasgow:* 26B, Renfield Street, C.2. *Manchester:* 260, Deansgate, 3.

VALVES...and their Applications

MINIATURE BATTERY VALVES

The Mullard preferred range of valves for battery operated receivers comprises four types which, between them, cover all normal requirements. They are :—

DK91, a heptode primarily intended as a frequency changer.

DF91, a variable-mu pentode for use as R.F. or I.F. amplifier.

DAF91, a short-grid-base pentode particularly suitable for A.F. voltage amplification, combined with a single diode.

DL94, an output pentode capable of output up to 270mW with 7% total distortion.

These valves are of the miniature type with all-glass B7G 7-pin base. The bulb diameter is 19mm. and the seated height approximately 50mm. These small dimensions make possible the design of very compact chassis, as required for portable sets, "personal" receivers and other miniature equipment.

The filament current is 50mA and the nominal filament voltage 1.4V. The output pentode has two 1.4V 50mA filament sections which can be connected either in series or parallel. It will thus be seen that the valves are suitable for operation with the filaments connected in parallel and supplied from a single-cell dry battery, or with the filaments connected as a series chain. The latter arrangement is adopted in A.B.C. receivers designed for supply from either batteries or mains.

In this and subsequent advertisements will be given the ratings and operating conditions for the valves in the range, and various application problems will be discussed.

MULLARD MINIATURE BATTERY HEPTODE DK91

The DK91 is a battery-operated heptode in miniature construction on the B7G 7-pin all-glass base. It is primarily intended for use as a frequency changer, and is suitable for A.V.C.

RATINGS AND CHARACTERISTICS

Filament

Suitable for D.C. operation only.

V_f	1.4 V
I_f	0.05 A

Capacitances

$c_{g3\text{-all}}$	7.0 μμF
$c_{a\text{-all}}$	7.5 μμF
$c_{g1\text{-all}}$	3.8 μμF
$c_{g3\text{-a}}$	<0.4 μμF
$c_{g3\text{-g1}}$	<0.2 μμF
$c_{a\text{-g1}}$	<0.1 μμF

Limiting Values

V_a max.	90 V
$V_{g2+g4(b)}$ max.	90 V
V_{g2+g4} max.	67.5 V
V_{g3} max.	0 V
$I_{k(o)}$ max.	5.5 mA

Operating Conditions

V_a	90 V
V_{g2+g4}	67.5 V
V_{g3}	0 V
R_{g1}	0.1 MΩ
r_a	0.6 MΩ
g_c	300 μA/V
$V_{g3}(g_c=5\ \mu A/V)$	−14 V
I_a	1.6 mA
I_{g2+g4}	3.2 mA
I_{g1}	250 μA
I_k	5.0 mA

Other valves in this range are:

DF91	Variable-mu pentode
DAF91	Short-grid-base pentode with diode.
DL94	Output pentode

Reprints of this article together with additional data may be obtained free of charge from the address below.

MULLARD LTD., Technical Publications Department, Century House, Shaftesbury Avenue, W.C.2.

MVM163

Wireless World

MAY 1951 VOL. LVII. No. 5

Questions About E.H.F. Broadcasting

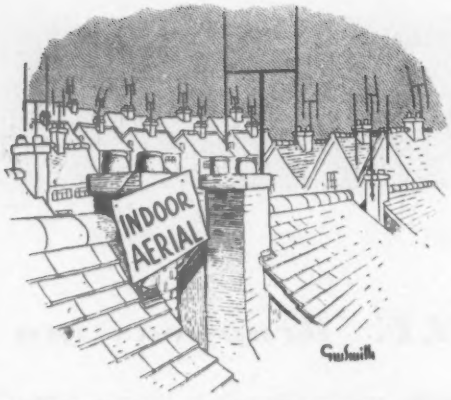
FEW of our readers will quarrel with the opinion that Great Britain cannot be given a full three-programme broadcasting service through the medium- and long-wave channels at present allocated. Even if the frequencies now monopolized by overseas transmissions were devoted to domestic purposes, there would still be some gaps to be filled. We cannot expect more m.w. and l.w. channels and so are forced to the conclusion that the use of extra-short wavelengths is essential for full coverage of these islands. That is why we so warmly welcomed the recommendation in the Beveridge Report that e.h.f. broadcasting should be developed as a matter of urgency. But can the National economy stand a full-dress e.h.f. scheme, or, if it cannot, is it worth while going ahead with piecemeal development? Can the radio industry, with its present commitments in the way of equipment for defence, produce sufficient receivers for public use to justify a start being made at once, and if so, on what scale? If the answer to all these questions is more or less favourable for an early start, we are still left with the over-riding problem as to whether amplitude or frequency modulation is to be used.

The comparative a.m./f.m. tests from the B.B.C. experimental station at Wrotham were, of course, instituted to give the answer to this last problem. Tests have now been going on long enough for conclusions to be reached, but as yet no official statement has been issued. However, the best-informed technical opinion inclines strongly to the view that the decision will be emphatically in favour of frequency modulation. This opinion is based not only on independent observations of the received signals, but also on information published on propagation tests from the Wrotham station. The tests, incidentally, seem to have been highly satisfactory, and to have shown that a modern high-power station on 90Mc/s, working with an effective aerial system, can have a service area that will bear comparison with that of an m.f. station.

As the subject of e.h.f. broadcasting was made a major issue in the Beveridge Report, the B.B.C. announcement on the system of modulation may possibly not be made until the Report is debated in Parliament. In the meanwhile, we will assume it will be f.m., but that does not settle all our problems even if we accept that f.m. is the best distribution system from the strictly engineering point of view. (That must obviously be the basis on which the B.B.C. report will be made.) Broadcasting, however, is at least as much a matter of reception as of transmission, and before we are committed irrevocably, more should be made public on the subject of receiver design, production, maintenance and especially economics. In fact, we encounter a whole new set of questions. What is the relative cost of f.m. and a.m. receivers? Can an f.m. receiver be properly maintained inexpensively and with the equipment likely to be available to the average technician? Unfavourable answers to these questions might swing us back to a.m., which offers at least the theoretical possibility of reception with cheap convertor units working with existing receivers. But can such convertors combine cheapness with adequate frequency stability?

As we see it, the answers to these questions and to many kindred ones that arise can only be given by the radio industry. The B.B.C. has done its part in providing means for a first-class comparison between the relative engineering merits of the competing systems of transmission; the only test of its kind ever to be made on such a large scale. We hope the industry, collectively and individually, will equally come to the fore in providing the reliable data on reception problems without which the final decision cannot be made with confidence.

Although *Wireless World* was at one time highly critical of proposals that seemed likely to saddle this country with an f.m. system of broadcasting before the merits of that system were proved, we are not "pro" or "anti" any particular method of modulation. All we want is to have some established facts to place before our readers, both with regard to transmission and reception. We hope that a detailed B.B.C. report on the Wrotham experiment, and also facts about receiver design and economics, will be made available at the earliest possible moment.



Reproduced by permission of the Proprietors of "Punch."

Indoor Television Aerial

Construction of a Slot Dipole for Reception

By H. PAGE,* M.Sc.

THE expansion of the television service brings with it the prospect of a forest of unsightly aerials sprouting up from chimney stacks in all parts of the country. Is this really necessary?

To obtain satisfactory reception it is essential that the aerial should provide a signal of high strength, free from electrical interference, at the receiver. High outdoor aerials are particularly suitable for this purpose; the strength of the wanted signal increases with aerial height and, in addition, the distance from sources of interference such as motor cars and domestic appliances increases. The high outdoor aerial, preferably made directional to discriminate against the main source of electrical interference, or against local reflections, offers the best solution to satisfactory television reception. The various forms of long wire aerials, and vertical rod aerials with one or more parasitic elements, fall into this class.

Indoor aerials have not previously been considered satisfactory except at short distances from the transmitting station, because they are either relatively insensitive to the signal or do not discriminate against interference. The author has for some years been using a rather uncommon form of indoor aerial, designed to be installed in the loft of a house—the region of highest signal strength indoors. It is in some ways superior in performance to the usual outdoor aerial with reflector installed at the same height, and can be used successfully up to considerable distances from the transmitting station. In view of the rapid growth of the television service and the need to avoid the use of outdoor aerials wherever possible, on aesthetic grounds, readers may be interested to know about this aerial and to decide the potentialities for themselves.

Description of Slot Aerial

The aerial, shown in Fig. 1, consists of a horizontal slot, approximately half a wavelength long, cut in a vertical sheet of conducting material—wire netting is satisfactory—the output leads being connected across the mid-points of the long sides. A horizontal slot responds to vertically polarized waves, maximum signal being received in the two directions normal to the plane of the conducting sheet. No novelty is claimed for the slot aerial, for it has been widely used in the past for the centimetric wavelengths; but, as far as the author is aware, it has not previously been proposed for television reception.

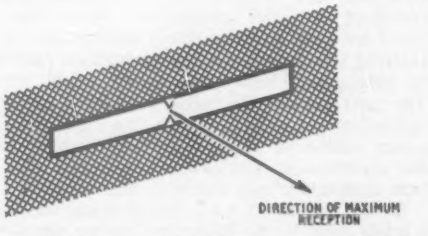
One difficulty about accommodating a vertical rod aerial array in the loft of a house is lack of vertical height. Using a slot aerial, however, space is required in the horizontal direction where it is usually readily available. It is necessary to erect the sheet on the correct bearing, that is, normal to the direction of the transmitting station. However, since the radiation pattern is fairly broad, it is quite satisfactory to have this adjusted to within about $\pm 10°$.

Performance

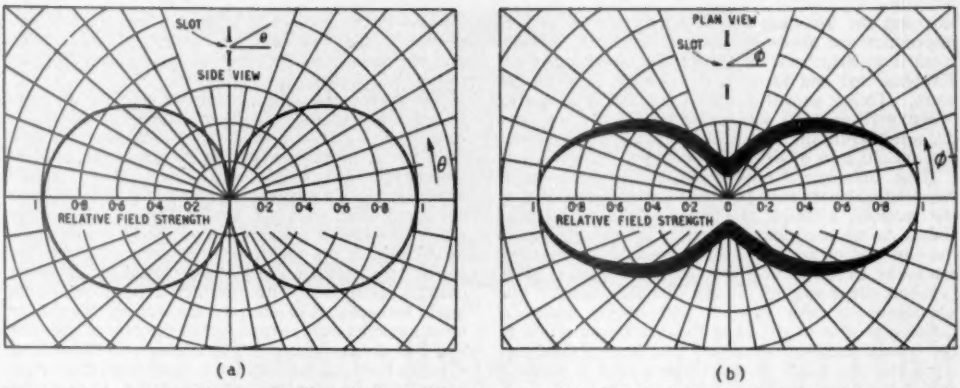
The slot has a figure-of-eight radiation pattern in the vertical plane and a figure-of-eight pattern with small minima in the horizontal plane. These patterns have been measured using a small-scale model, carrying out tests at correspondingly higher frequencies.

Fig. 2 (a) shows the vertical-radiation pattern, this shape being unaltered over the 10 per cent frequency band required for television. Fig. 2 (b) shows the horizontal-radiation pattern, the blocked-in portion indicating the variation over a 10 per cent frequency band. Compared with more conventional aerials the change in directional pattern with frequency is remarkably small, and the minimum is sharper—the

Fig. 1. This sketch shows the general form of the slot aerial.



* B.B.C. Research Dept.



(a) (b)

Fig. 2. Vertical (a) and horizontal (b) radiation patterns of slot aerial. The shaded area indicates the change which occurs with a 10% change of frequency.

ratio of maximum to minimum pick-up varies between 14 db and 18 db relative to the main lobe.

Evidently the slot aerial is most suitable for discrimination against interference arriving at right angles to the direction of transmission. As the main lobe is fairly broad it may be worth while to adjust the direction of the slot to reject local interference rather than for maximum pick-up.

It is possible to derive the theoretical gain of the aerial from Fig. 2 (b), making the reasonable assumption that the vertical-radiation pattern does not change with azimuthal angle. The gain over a vertical half-wave dipole is found to be 4 db—a little higher than that of the conventional H-type aerial. Moreover, this gain is substantially unchanged over the working frequency band—a consequence of the relatively small changes in the radiation patterns.

The impedance of the aerial also changes relatively slowly with frequency, being similar to that of a centre-fed dipole of the same shape as the slot.

From the point of view of constancy with frequency of the radiation patterns, gain and impedance, the slot is, therefore, a wideband aerial. The only advantage of the conventional H aerial is that it is a relatively simple mechanical structure, and so can be erected well above loft level. Unless this is done, and advantage taken of the increase in wanted signal strength with height (or of locating the aerial far from the sources of interference), it is difficult to justify the use of an outdoor aerial.

It is interesting to note that, if the slot were cut in an infinite sheet, the ideal case usually considered in theoretical investigations, neither the radiation pattern nor the aerial gain would be as favourable for this application.

Construction

The method of construction of the slot aerial, and the dimensions for the London wavelength, are shown in Fig. 3. The corresponding dimensions for the Midland service are, of course, obtained by scaling in the same ratio as the wavelengths. The slot is 10ft long and 1ft wide in a sheet of wire netting 14ft long and 5ft wide. The slot dimensions are important, but the size of the netting is not very critical, and can be changed if more convenient; a large reduction in size should, however, be avoided. The edges of the slot are bonded with wire to preserve the shape. At the centre points of the long sides, two triangular pieces of metal are fixed, to taper in to the transmission line which connects the aerial to the receiver; the impedance of the slot at the point of connection is approximately 600 ohms. This can be connected through the usual type of balanced transmission line, which has a characteristic impedance of about 100 ohms, directly to the television receiver. It is, however, preferable to match the two impedances, using a quarter-wavelength line transformer having a characteristic impedance of 250 ohms, between the

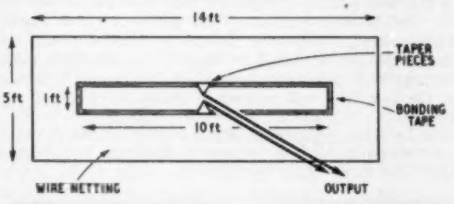


Fig. 3. Dimensions of slot aerial for the London area.

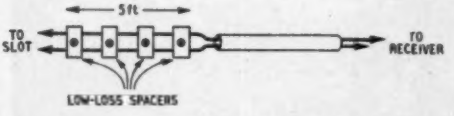


Fig. 4. Quarter-wave matching transformer made by increasing the wire spacing at the end of the feeder.

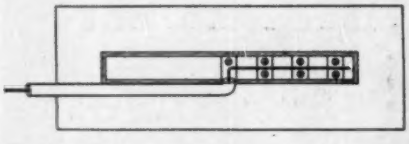


Fig. 5. Method of connecting a coaxial cable to the slot aerial.

slot and the 100-ohm line. Balanced lines of this impedance are available, but a convenient arrangement is to strip back the sheath and screening of the 100-ohm line and increase the spacing between the wires. This is shown in Fig. 4 and the spacing (between wire centres) should be four times the wire diameter, while the length of this widely-spaced section should be a quarter wavelength.

If an unbalanced connection to the slot aerial is required, in order to use a coaxial cable connection to the receiver, a simple modification makes this possible. An open-circuit wire or rod, half the length of the slot and of any convenient diameter, is fixed by insulators, as shown in Fig. 5, and connection is made between either side of the slot and the centre. The impedance in this case is 150 ohms, which is sufficiently near to the ideal for direct connection to the normal unbalanced cable. The latter should run along the slot edge, to which the screen is bonded, and then to the receiver.

Some difficulty may be experienced in handling a roll of wire netting in the confined space of a loft. Strings joining the longer sides of the slot at intervals along its length, and between the apices of the triangular connection pieces, will be found useful in preserving the shape of the slot. If nails are fixed in the rafters and joists, the netting can be temporarily hooked on to them and gradually manœuvred into position. The flatness of the netting is not important, but metal pipes or other conductors near the slot should be avoided.

The author has used this type of aerial at two sites 25 miles and 45 miles from Alexandra Palace; in one case the roof was tiled and in the other slate. At both sites direct comparison was made against an outdoor half-wave dipole at the same height above ground level; a signal gain of approximately 3 db was measured when using the slot, indicating that the loss due to absorption in the roof is negligible. Moreover, in the case of the tiled roof, measurement of the received field strength over a long period indicated no changes associated with weather conditions, which might be expected to affect the absorption. No similar measurements were carried out in the case of the slate roof but the consistency of reception at a distance of 45 miles from Alexandra Palace, apart from the fading normally to be expected at this distance, leads to the same conclusion.

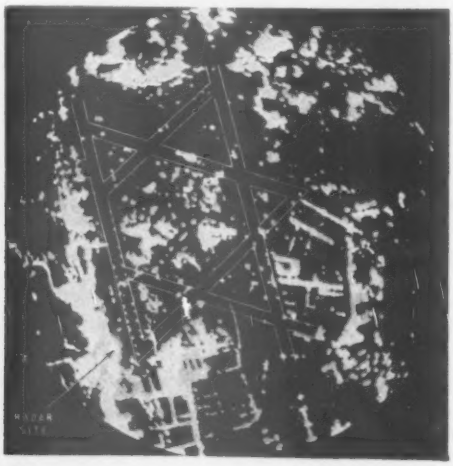
Further improvements of both the radiation pattern and aerial gain may be obtained by using more complicated arrangements, but these will not in general be practicable in the loft of the average house. The simple slot aerial described appears to offer the best compromise between complexity and performance.

AIRFIELD SURFACE MOVEMENT INDICATOR

New Ground Control Navigation Aid

THE majority of navigation aids now in use on the civil airways are concerned with aircraft in flight, but a new equipment recently demonstrated by Cossor Radar at London Airport is primarily concerned with the movement of aircraft and vehicles on the runways and perimeter tracks.

P.P.I. display of London Airport as seen on the screen of the Cossor A.S.M.I. equipment. Runways have been sketched in for easy interpretation.



In the interests of safety it is important that runways be clear of obstructions before any aircraft be permitted to land or take off, and in conditions of poor visibility all parts of the airport may not be clearly visible from the control tower.

The A.S.M.I. (Airfield Surface Movement Indicator), as it is called, operates on a wavelength of 3 cm and uses a curved rectangular scanner measuring 12 ft wide. The "aerial" is a small horn at the end of a waveguide and located in front of the scanner. This, combined with a pulse width of 0.1 microsecond, gives a beam $\frac{1}{2}$ deg only in azimuth and 15 deg in elevation, and very high discrimination is possible.

Display is of the P.P.I. kind on a 15-in c.r. tube. The centre of the radial time base can be shifted to any part of the tube face in order to provide the maximum display area in cases where the A.S.M.I. equipment is located at one corner, or to one side, of the airfield.

With the scanner mounted on the roof of a van the whole of London Airport was clearly displayed on the tube, definition being such that the runway lighting lamps were easily discernible. A small car showed up well and even the driver walking away from the car was noticed by keen-sighted observers.

All buildings are naturally visible as permanent echoes and, as the photograph of the P.P.I. screen reproduced here shows, it would not be easy in this case to pick out a small moving object on one of the runways. It was suggested at the demonstration that the "p.es" be blacked out by means of a positive transparency superimposed on the screen. Moving objects would then be more readily discernible.

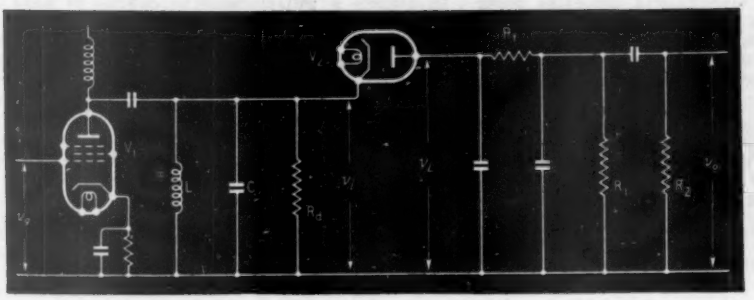


Fig. 1. Circuit of typical diode detector with the r.f. stage feeding it and showing its load circuit.

Diode Detector Distortion

A Common Misconception

By W. T. COCKING, M.I.E.E.

MUCH has been written about the distortion which the diode detector can introduce when its a.c. and d.c. loads are unequal. The treatment of the effect of the loads is usually incomplete, however, and as a result the importance of the load ratio is often magnified out of all proportion with reality.

The usual analysis shows that there is a maximum depth of modulation which can be allowed in the signal applied to the diode detector if distortion is to be avoided, and that this depth of modulation depends on the ratio of the a.c. to the d.c. loads. This result shows that, for ordinary values of components, serious distortion occurs whenever the modulation depth exceeds some 70–80 per cent. Now, ordinary listening tests show that this serious distortion does not, in fact, occur; very serious audible distortion can be observed with grossly unsuitable component values, but not with normal ones.

There is nothing wrong with the theory on which the expectation of distortion is based. The distortion occurs and is audible if the modulation depth of the signal input to the diode exceeds the calculated value. However, what is usually overlooked is the fact that the modulation depth of the signal applied to the diode is appreciably less than that of the incoming signal. The modulation depth is reduced by the action of the diode circuit itself and the lower the ratio of a.c. to d.c. loads, the more is it reduced. There is an automatic compensating action on the diode input circuit which makes the requirements for the avoidance of distortion much less severe than is commonly supposed.

This beneficial effect of the diode on its input circuit is no new discovery.[1] For some obscure reason, however, it is usually overlooked. It comes about because the diode detector has a lower input impedance to a changing r.f. voltage than to one of constant amplitude. As a result the input tuned circuit is more heavily damped for the modulation than for the carrier; the gain of the preceding stage is lower for the modulation than for the carrier, and so the modulation depth of the signal applied to the detector is less than that of the incoming signal. A finite ratio of a.c. to d.c. diode loads limits the modulation which the detector can deal with without distortion, but at the same time it reduces the modulation depth of the signal applied to the detector. The net result is that the requirements for the avoidance of distortion are much less severe than is commonly supposed.

Consider the diode circuit shown in Fig. 1. With an unmodulated carrier of peak value v_i applied to the diode the steady voltage developed across the d.c. load $R_f + R_1$ is $v_L = \eta v_i$ where η is the rectification efficiency and, for normal conditions, is 0.9 or more. The current in the d.c. load R_{dc} is, therefore, $i = v_L/R_{dc} = \eta v_i/R_{dc}$.

With a modulated input of modulation depth m, the input voltage varies during the modulation cycle from $v_i(1 - m)$ to $v_i(1 + m)$; that is, it changes by $\pm mv_i$ about the unmodulated value v_i. The load voltage correspondingly changes about the unmodulated value $v_L = \eta v_i$ by $\pm m\eta v_i$.

The current must change accordingly, but the current now flows in the a.c. load $R_{ac} = R_f + R_1R_2/(R_1 + R_2)$, so the change of current is $\pm m\eta v_i/R_{ac}$ about the unmodulated value $\eta v_i/R_{dc}$. Since the current through the diode cannot reverse, this result is true only if the change of current during modulation does not exceed the unmodulated current. Therefore we must have

$$\frac{m\eta v_i}{R_{ac}} \leqslant \frac{\eta v_i}{R_{dc}} \text{ or } m \leqslant R_{ac}/R_{dc}$$

This is the relation which is usually employed to compute the capabilities of the detector. Typical practical values are: $R_f = 50\text{k}\Omega$, $R_1 = 220\text{k}\Omega$, $R_2 = 470\text{k}\Omega$. Therefore, $R_{dc} = 270\text{k}\Omega$ and $R_{ac} = 200\text{k}\Omega$. The maximum modulation depth for the avoidance of distortion is, therefore, 0.73.

This is considered poor because, although it is really the maximum depth of modulation at the detector input, it is taken, incorrectly, to be the maximum for the incoming signal.

The input impedance of the detector is easily

[1] "The Properties of a Resonant Circuit loaded by a Complex Diode Rectifier," by F. C. Williams, *Wireless Engineer*, November 1938, p. 600. See also "Radio Receiver Design," by K. R. Sturley, Vol. 1, p. 363 (Chapman & Hall Ltd.).

computed. With an unmodulated signal the power in the load circuit is $(\eta v_i)^2/R_{d(dc)}$. This same power would be absorbed by a resistance $R_{i(dc)}$ shunted across the tuned circuit and would be $v_i^2/2R_{i(dc)}$. The factor 2 arises because the r.m.s. value of v_i is $v_i/\sqrt{2}$. Therefore

$$R_{i(dc)} = R_{dc}/2\eta^2$$

By a similar process of reasoning the input resistance for the modulation is

$$R_{i(ac)} = R_{ac}/2\eta^2$$

Now the amplification of the stage V_1 with an unmodulated input is

$$\frac{g_m}{\frac{1}{r_a}+\frac{1}{R_d}+\frac{1}{R_{i(dc)}}}$$

where r_a is the a.c. resistance of V_1, g_m its mutual conductance and R_d is the dynamic resistance of the tuned circuit alone. For the modulation the amplification is given by the same expression with $R_{i(ac)}$ substituted for $R_{i(dc)}$.

Since $R_{i(ac)}$ is less than $R_{i(dc)}$ the amplification in the second case is less than in the first. This is equivalent to a reduction in the depth of modulation m of the signal applied to the diode compared with that, m_s, of the signal applied to V_1. The ratio of the amplifications under the two conditions gives the ratio of the modulation depths and so

$$\frac{m}{m_s} = \frac{\frac{1}{r_a}+\frac{1}{R_d}+\frac{1}{R_{i(dc)}}}{\frac{1}{r_a}+\frac{1}{R_d}+\frac{1}{R_{i(ac)}}} = \frac{1+R/R_{i(dc)}}{1+R/R_{i(ac)}}$$

where $R = \dfrac{r_a R_d}{r_a + R_d}$

Inserting the values of the input resistances in terms of R_{ac} and R_{dc}, this becomes

$$\frac{m}{m_s} = \frac{1+2\eta^2R/R_{ac}}{1+2\eta^2R/R_{dc}}$$

Combining this with the earlier formula for the maximum depth of modulation at the detector input we get for the maximum depth in the incoming signal

$$m_s \leqslant \frac{R_{ac}}{R_{dc}} \cdot \frac{1+2\eta^2R/R_{ac}}{1+2\eta^2R/R_{dc}}$$

Now if the dynamic resistance of the tuned circuit, in shunt with the a.c. resistance of V_1, is 200kΩ and we reckon the detector efficiency as 100 per cent, we get for the previous values

$$m_s \leqslant 0.73 \frac{1+400/200}{1+400/270} = 0.73 \times 1.12 = 0.82$$

This is a very appreciable increase in the maximum modulation depth.

It is clear from the equation that if $2\eta^2R$ is large compared with R_{dc}, the permissible modulation depth tends to unity irrespective of the actual value of R_{ac}/R_{dc}. In the limiting case of no tuned circuit losses and a valve V_1 of infinite a.c. resistance, the circuit is completely self-compensating and the a.c./d.c. load ratio can be anything without introducing distortion. In practice this cannot be approached.

In order to minimize detector distortion the proper steps can clearly be seen to be:

(1) Make R as high as possible. This entails the use of a valve of high a.c. resistance for V_1 and a tuned circuit of high dynamic resistance. This does not necessarily require a high-Q circuit, for R_d can be made large with a low Q by using a high L/C ratio. Nevertheless, a high Q will usually be an advantage. In practice it will probably be difficult to make R greater than 200kΩ, and it may often be less.

(2) Make R/R_{dc} as large as possible. According to the discussion of this article there is no limit to the extent to which R_{dc} can be reduced. However, not everything about detector design has been considered. It is actually necessary to make R_{dc} and R_{ac} as high as possible compared with the resistance of the diode. Unless this is done a different form of distortion will arise through a gradual curvature of the input-output characteristic and the efficiency will be appreciably below unity. In general, R_{dc} should not be much below 200kΩ for the ordinary diodes, but can be of the order of 100kΩ for the low-resistance types such as the EA50 and 6AL5.

(3) Make R_{ac}/R_{dc} as large as possible. Since this depends on the grid leak R_2 of the following valve, as well as upon R_f and R_1, it involves making R_2 as large as possible. In its turn this depends on the type of following valve. When this is an output valve R_2 can rarely exceed 0.5MΩ, but with a small triode amplifier it can usually be 2MΩ. If it is a cathode-follower or a cathode-follower type phase-splitter the effective value may be 10–20 MΩ because of the negative feedback in this stage.

As an example of what can be done, let $R_2 = 2.2$ MΩ and fix the filter resistor R_f arbitrarily at 50kΩ. Let R_1 be 100kΩ, and R 200kΩ. Then $R_{dc} = 150$kΩ and $R_{ac} = 145.6$kΩ. Assuming further that $\eta = 0.95$ we get

$$m_s \leqslant \frac{145.6}{150} \cdot \frac{1+(400\times0.9)/145.6}{1+(400\times0.9)/150} = \frac{145.6}{150} \times \frac{3.47}{3.4} = 0.99 \text{ to slide-rule accuracy.}$$

In conclusion it should be noted that the results given here apply only to a single-tuned circuit coupling between the r.f. valve and the detector. This can, of course, be a transformer instead of the choke-fed arrangement of Fig. 1. The results do not necessarily apply to a coupled-pair of tuned circuits of the band-pass type, however. A similar effect does occur with such circuits but the formulæ given here do not apply to this case.

BOOK REVIEW

Time Bases (2nd Edition). By O. S. Puckle, M.B.E., M.I.E.E., Pp. 387+xxi, with 257 diagrams. Chapman & Hall, Ltd., 37 Essex St., London, W.C.2. Price 30s.

THIS second edition of a well-known book is to be welcomed for the addition of a great deal of information about modern time-base technique.

The most important of the additions are a considerable expansion of the section on linearization, the chapter on Miller-capacitance time bases, and the additions to "Push-Pull Deflection." There is also much new material about differentiating and integrating circuits, simple computing systems, frequency division and counting.

The book is largely non-mathematical. In the few places where a mathematical analysis does occur it is nearly always of quite simple type.

The time bases described are nearly all for electric deflection. Some magnetic-deflection circuits are included but they are much less fully treated. The book provides a vast amount of information about circuits and methods suited to the c.r. oscilloscope. The saw-tooth generators which are so fully treated are, of course, applicable to any method of deflection, but the information about ways of obtaining the current saw-teeth needed for magnetic deflection is meagre.

The book is well produced and few misprints were noticed. It is one which can be confidently recommended to engineers and students alike. W. T. C.

Festival of Britain

Radio Equipment to be shown in the Main Exhibitions

THE aim of the South Bank Exhibition, which will be opened by H.M. the King on May 3rd, is to present a broad review of British practice in the arts, sciences, technology and industrial design. As would be expected, therefore, radio and electronic equipment will be featured in a number of the pavilions. Radio equipment is also included in the Land Travel Exhibition (which visits Manchester from May 5th-26th), the Festival ship *Campania* (visiting Southampton, May 4th-14th, and Dundee, May 18th-26th), and the Exhibition of Industrial Power which opens in the Kelvin Hall, Glasgow, on May 28th.

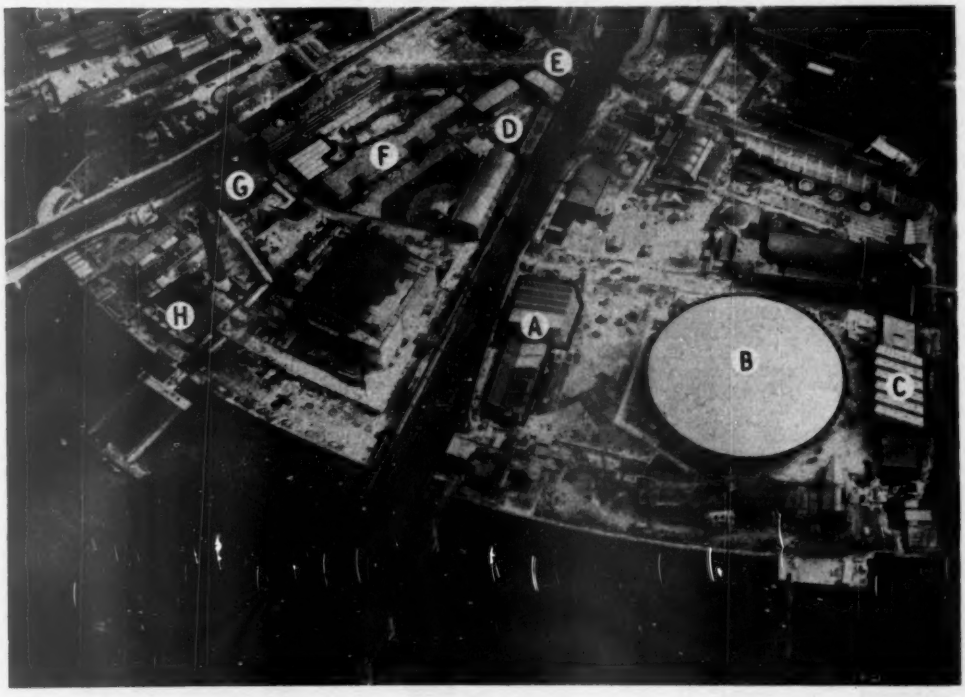
We give below a list of most of the modern radio gear chosen by the Festival authorities for inclusion in the four main exhibitions. In addition a considerable amount of historic apparatus has been borrowed from manufacturers, the B.B.C. and G.P.O. for the Transport Pavilion (South Bank), the aim of which is to give a comprehensive review of British developments in communications.

SOUTH BANK EXHIBITION

Manufacturer	Products
Ardente	Loudspeaking intercom. with loud-hailer.
Audix B. B.	Schools' radio equipment.
Automatic Telephone & Electric Co.	6-channel portable v.h.f. transmitter/receiver, and v.h.f. radio telephone.
B.I. Callender's Cables	Television cable and coupler.
Birmingham Sound Reproducers	Mobile battery amplifier.
British Ferrograph Recorder Co.	Magnetic-tape recorders and reproducer.
Bullers	Aerial insulator for Rugby.
Bush Radio	Television receiver (TUG 24).
Cathodeon	"Photocon" television camera tube.
Central Rediffusion	Radio relay installation.
Cinema-Television	Equipment for Telecinema Cathode-ray tubes and gas-filled photocell.
Cole, E. K.	Airborne search radar; Television receivers TSC 113, TS 114 and TC 140; 4-station "Festival" receiver (A147); and Export radiogram, ARG 90.
Columbia	Records.
Cossor Radar	G.C.A. remote console and airborne "Gee" receiver.
Decca Navigator Co.	Decca Navigator gear and charts.
Decca Radar	Radar display unit (159A) and scanner.
Decca Record Co.	Record player; Long-playing records; Pickup with interchangeable heads; and Mains/battery portable (DD46).
Edison Swan Electric Co.	Apparatus for measurement of the ratio of charge to mass of an electron.
E.M.I.	Studio magnetic-tape recorder (BTR-1B); Battery-operated radiogram.; and Projection television receiver (built in).

(*Continued on following page*)

On this view of the South Bank Exhibition site taken a month before the opening day has been indicated the sections and buildings in which radio and electronic equipment will be exhibited and demonstrated. A, Transport; B, Dome of Discovery; C, Power and Production; D, Television; E, Telecinema; F, Homes and Gardens; G, Schools; and H, Sport, nearby which is the Shot Tower carrying the lattice paraboloid for the "radio telescope." (*Courtesy Aerofilms*)



Manufacturer	Products
Emitron Television	"Emitron," "Super Emitron" and "C.P.S." television camera tubes; Multiplier phototube; Television cameras, microwave link equipment and console monitor for 625-line demonstration; and Hospital television equipment.
English Electric Co.	16-in. glass/metal c.r.t.
Ever-Ready Co.	Tropical receiver, Model "J."
Evered & Co.	"Azdar" rectangular wave guides.
Ferranti	Airborne distance measuring equipment; Airborne "Consol" receiver; Television receivers T1405 and T129; and Broadcast receiver 148.
Fielden (Electronics)	"Tektor" proximity detector.
Films & Equipments	Multi-way connectors for radar.
Fitton, R. N.	Experimental a.m./f.m. receiver designed for the B.B.C.; "Ambassador" receiver 650/CR; and Television set TV.2/TM.
Furzehill Laboratories	Beat frequency oscillator, Model 2232.
Garrard Engineering Co.	Transcription-type turntable (201B/2); Three-speed record changer (RC80); and Single 3-speed record player (M).
General Electric Co.	V.H.F. radio-telephone for railway locomotives; Communications receiver (BRT 400); Fixed-frequency v.h.f. receiver (BRT 186); cavity magnetron; and 900-Mc/s tuned circuit for television relay.
Goodmans Industries	12in. twin-cone loudspeaker "Axiom 22."
Gramophone Co.	Records.
Grampian Reproducers	15-W receiver-amplifier (Model 461); Direct disc recorder; and Sound reproducing equipment.
Hunt, A. H.	Capacitors.
Industrial Radio Co.	Marine receiver "Consol 66."
International Marine Radio Co.	Medium-wave telegraph transmitter (IMR. 51); Short-wave telegraph transmitter (IMR.53); Emergency marine transmitter (IMR.61); Radio-telephone transmitter/receiver (IMR.43/36); Marine communication receiver (IMR.42); Auto alarm (IMR.28); and Emergency receiver (IMR.60).
Invicta Radio	Mains/battery portable (Model 550).
Johnson Matthey	Waveguides.
Kelvin & Hughes	Waveguide assembly.
Kolster-Brandes	Broadcast receivers FB10 and FR10.
Marconi Instruments	Universal bridge, TF868; Output power meter, TF893; and moisture meter, TF874.
Marconi International Marine Communication Co.	Marine direction finder; Radar scanner; and Lifeboat radio equipment (Type 110A).
Marconi's Wireless Telegraph Co.	Components for universal racking system developed for British aircraft radio; v.h.f. portable simplex telephony transmitter-receiver (H.19); Airborne h.f. transmitters (AD.107) and h.f./m.f. receivers (AD.94); Automatic d.t. receiver (7092A); Marconi-B.C.C. mobile v.h.f. simplex transmitter-receiver; Hand microphone; and Marconi-Brown telephone headset.
McMichael Radio	Portable receiver.
Metropolitan-Vickers	Marine navigational radar.
M.S.S. Recording Co.	Cellulose Nitrate coated recording disc; and Twin channel direct recorder.
Muirhead & Co.	"Mufax" facsimile receivers and "Mufax" picture monitor.
Mullard Electronic Products	Miniature valves; Radar-sonde transponder; and Broadcast set (MAS277).
Murphy Radio	Television receivers V150 and V176; Baffle console receiver; Portable mains receiver (U144); Export receiver (A.160); Radiogramophone (172); and Apparatus demonstrating the waveform of a chosen line from a television picture.
Parmeko	Monitor loudspeaker unit for the B.B.C.
Philco (Overseas)	Radiogramophone "Richmond."
Philips Electrical	Television receiver (385U).
Plessey Co.	Motor cycle radio-telephone equipment; and components.
Pye	O.B. television camera; Television studio control and monitoring equipment; Fixed station v.h.f. transmitter/receiver; Broadcast receivers A.39J, 49 and a portable; Export radiogramophone (PE39RG); and Television receiver (BV30).
Radio Gramophone Development Co.	3-speed radiogramophone (1O46G3).
Radio Heaters	R.F. induction heater.
Redifon	Trawler direction-finding loop (DFL 5); 100-W marine transmitter for m.f. telegraphy and h.f. telegraphy/telephony; Marine d.f. receiver (R81); General purpose marine receiver; Emergency receiver (R56); Trawler control unit and speech amplifier (RC.12/A 137); and Remote control unit for v.h.f. equipment (RG 20).
Roberts' Radio Co.	Portable receivers.
Salford Electrical Instruments	Radio-sonde balloon transmitter and ground station.
Sargrove Electronics	Photo-electric automatic mechanism for sorting and batching.
Scanners	Microwave generator and receiver.
Simon Sound Service	Domestic tape recorder.
Sound Sales	Schools' trolley equipment (A/12).
Standard Telephones & Cables	Single-ended 160-kW water-cooled triode (3Q/331E); Time-sharing multiplex radio-telephone link terminal (D.P.1.); 140-channel v.h.f. transmitter-receiver (S.T.R.12); Instrument landing system receivers, localizer and marker beacons; Remote console for G.C.A.; Cathode-ray engine indicator; and Portable battery chargers.
Stratton & Co.	"Eddystone" receivers 680 and "All-World Six."
Telegraph Construction Co.	Polythene cables and micro-wave components.
Ultra Electric	Communication control equipment (UA.17).
Union Radio Co.	Automatic ionospheric recorder.
Vidor	Portable receivers CN396 and CN411.
Vitavox	Hand microphone (B50).
Walter's Electrical	Morse Key (Type 5KK).
Whiteley Electrical Radio Co.	Loudspeakers 50/6C and 50/5C; Sectioned model of "Stentorian" 12in. Concentric duplex loudspeaker; and Radio-sonde balloon transmitter.

LAND TRAVEL EXHIBITION

Advance Components	Signal generator, Model E.
Allan, Richard, Radio	Loudspeaker ("Baby Bafflette" 660).
All-power Transformers	Power supply unit (1120).
Amplivox	Headphones (Type 1900).
Automatic Coil Winder Co.	25-range Avometer.
Bush Radio	Portable (BP10).
Cole, E. K.	"Ekco Princess" portable and pencil soldering iron.
Decca Record Co.	Mains/battery portable, DD46.
E.M.I.	Absorption wavemaker.
Fitton, R. N.	Corner console television (TV2/CR).
Henley's	"Solon" soldering irons.
Imhof, Alfred	Television screen surround, for building receiver into wall.
Kolster-Brandes	Television receiver (EV.30).
Labgear	Low-power high-stability oscillator.
Metropolitan-Vickers	Miniature oscilloscope, Type 244.
Multicore Solders	"Ersin" Multicore solder.
Motor & Air Products	Television enlarging lens.
Panda Radio Co.	Rotary dual 20/10-metre aerial array, mounted on steel tower.
Q-Max (Electronics)	Communications receiver (Q5/10X).
Reslosound	Ribbon microphone.
Roberts' Radio Co.	Portable receiver.
Romac Radio Corp.	Personal receiver (236).
Standard Telephones & Cables	Cross section of polythene insulated co-axial cable.
Stratton & Co.	Communications set "Eddystone" 750.
Telegraph Construction Co.	Co-axial feeder cable and Selsyn cable.
Teleradio	100-watt amateur transmitter.
Universal Electronic Products	Tuner units.
Walter's Electrical	Morse key.
Webbs Radio	Great circle map.
Whiteley Electrical	Loudspeakers.

"CAMPANIA" FESTIVAL SHIP

Ace Radio	Broadcast receiver (33).
Decca Navigator Co.	Decca Navigator.
Decca Record Co.	Long-playing records; Dual-speed "Decca" record player; and "Double Decca" portable.
Gramophone Co.	H.M.V. television receiver (1807A).
Kelvin & Hughes	Marine radar equipment (Type 2).
Marconi Instruments	Moisture Meter TF933.
Marconi International Marine Communication Co.	"Oceanspan" telegraphy transmitter; "Reliance" medium-wave telegraphy transmitter; "Electra" and "Mercury" receivers; "Lodestone" direction-finding equipment; "Oceanic" broadcast receiver; and "Vigilant" auto-alarm.
Murphy Radio	Television receiver and component parts; Portable (B.165); and Export set (152).
Pye	Export receiver (PE.37).
Redifon	Marine communications receiver (R.30).
Thorn Electrical Industries	"Ferguson" broadcast receiver (208U).

KELVIN HALL, GLASGOW

Cinema-Television	Industrial electronic metal detector.
Ferranti	Broadcast receiver (248).
Kelvin & Hughes	Demonstration of marine radar using simulated signals from a model.
Marconi	Marine d.f. equipment and echometers.
Murphy Radio	Broadcast receiver (168M).
Radio Heaters	Portable short-wave therapy unit.
Redifon	7-kW r.f. induction heater (IH.39).

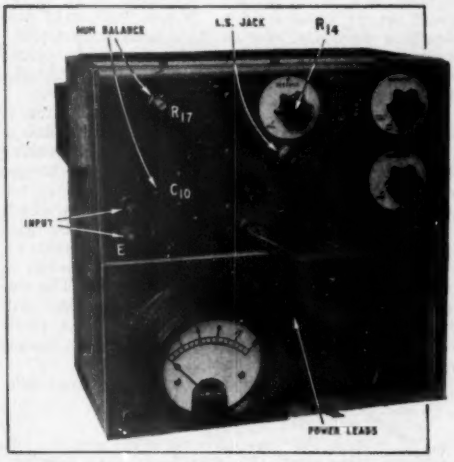
Sensitive Null Detector

Selective A.F. Bridge Amplifier Giving Visual and Aural Indication of Amplitude Variation over 10μV to 10V Range Without Manual Gain Adjustment

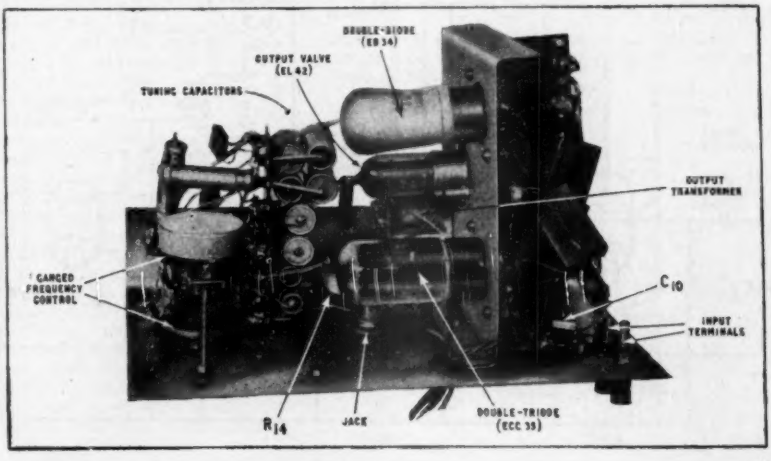
By M. G. SCROGGIE, B.Sc., M.I.E.E.

THE usual instrument for detecting the balance point in bridges and other null systems of measurement is a pair of phones. It is a simple and inexpensive device, and, in conjunction with the human ear, is a quite remarkably sensitive detector of a.f. currents in the frequency range around 1,000 c/s. Its limitations emerge, however, when it is necessary to perform measurements at much lower or higher frequencies, or in noisy situations, or with great accuracy. The combined sensitivity of phones and ear at, say, 50 c/s is so poor as to be practically useless, and it becomes necessary to substitute a visual detector preceded by amplification. A surprisingly small amount of background noise is sufficient to put phones out of effective action; and in really noisy places no amount of amplification solves the problem, for the "threshold of pain" intervenes; again, a visual indicator is necessary. Even in a haven of quietness, and at the most audible frequencies, it is not always possible to detect the null point with phones so precisely as to reap the full benefit from highly accurate bridge standards. A standard accurate to 0.05 per cent is hardly worth having if one cannot estimate balance within a ±0.2 per cent range of its scale. Again, amplification is needed.

It is easy enough to make up an amplifier, but if it is just any amplifier it will certainly not be an unmixed blessing. The lower levels of signal that can be explored by it are likely to be obscured by hum. Even if the wave form of the signal source is beyond reproach, harmonics are generated in the bridge itself when measuring iron-cored components. Until one is somewhere near balance, the amplification is a positive nuisance. A manual gain control is a partial solution, but is one more knob to adjust, and the shock of accidentally going right off balance when



Above : Complete unit, with amplifier in top half and power unit and balance indicator below.



Amplifier chassis of the detector unit.

maximum gain is in force is unpleasant, to say the least. Automatic gain control does not necessarily solve the problem, because the range of signal that may have to be handled is so large that when flattened out enough to be easy on the ear it becomes very difficult to tell whether adjustment of the bridge is bringing one nearer balance or farther off.

The object of the design to be described was to provide ample sensitivity free from all these drawbacks, over the widest possible range of measurement. It was considered necessary to be able to tune the detector to at least 50 c/s and 1,000 c/s, and preferably also to 400, 796 (i.e., $2\pi f = 5{,}000$) and 1,592 ($2\pi f = 10{,}000$). The effective range of signal input was to be about 10 μV to 10 V, without manual adjustment. This obviously meant a.g.c., and to keep the amplifier sensitive to *changes* of amplitude over such a range it was decided to give it a time constant such as to indicate the direction of change by a transient effect, at any point on its characteristic. Visual indication was clearly a necessity, but as it is usually preferable, whenever possible, to keep one's eyes on the bridge adjustments, use of loudspeaker or phones should also be available.

A cathode-ray tube has the special qualification as a visual indicator that if great care has been taken to avoid phase shift in the amplifier at any of the working frequencies it is possible not only to observe changes in amplitude but also in phase, and thereby to tell whether it is resistance or reactance that most needs adjustment in order to reach balance. The gain required to give a really sharp balance indication on a c.r.t. is very large, however; and its minimum to maximum range of indication is limited. The requirements laid down are difficult to combine with absence of phase shift, and the apparatus as a whole would be elaborate and expensive; so the c.r.t. system was rejected.

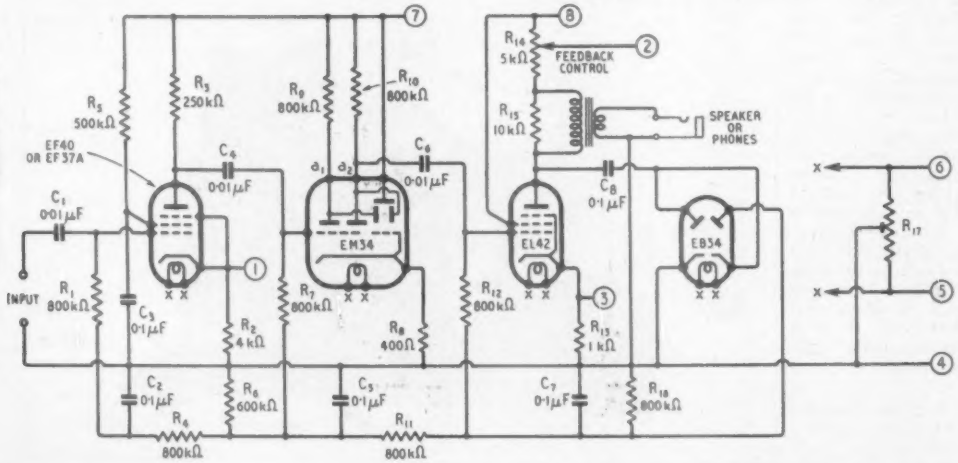
A simpler, smaller and more sensitive visual indicator is the "magic eye" and as a further economy the triode section can be used as a voltage amplifier to drive the output valve needed to work a loudspeaker and provide a.g.c. and tuning facilities. By the time an entirely satisfactory design had been produced along these lines it suddenly became apparent that the milliammeter which was being used to monitor the output valve was much more clearly visible than the tuning indicator, and at the present time is obtainable at a lower price—accuracy being completely unimportant. So an alternative design was developed accordingly. Since there may be reasons for preferring the "eye" in particular cases, or in other ways of varying the details to fit in with items in stock or special requirements, both circuits are given here, and the accompanying comments are devoted mainly to pointing out where departure from them brings trouble and where it does not.

Three-unit Circuit

To simplify the diagrams, the tuning circuit is shown separately (Fig. 3), and so is the power unit (Fig. 4). Any power unit capable of supplying the necessary heater current for the valves and about 14 mA at 250 V will do, provided that the smoothing is reasonably good and the output impedance is kept fairly low by not less than about 32 μF.

The circuit of the "eye" type amplifier is shown in Fig. 1. The EM34 indicator has the particular advantage of two "scales," one of about 4½ volts and the other of about 15, which helps it to cover the full signal range effectively. It may be worth mentioning, however, that within a rather narrower range a 6E5 worked reasonably well. In the output stage the octal-based EL33, on account of its high gain, was especially suitable. It is now on the replacement list, however; the B8A-based EL41 is electrically equivalent for this purpose, and is physically much smaller.

Fig. 1. "Magic eye" version of the bridge amplifier. The indicator valve (EM34) serves also as a voltage amplifier to drive the output valve. The amplifier as shown here has a nearly flat frequency characteristic, but with the frequency-discriminating feedback circuit (Fig. 3) connected to points 1-4 it can be tuned over selected frequency bands. Points 4-8 are connections to the power unit (Fig. 4). A voltage-doubler rectifier provides a.g.c. bias, which also operates the indicator.



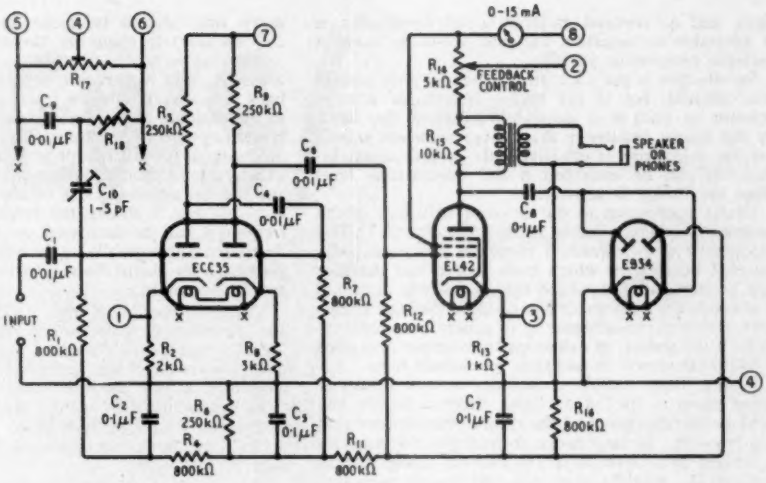


Fig. 2. Alternative version of the amplifier, with a milliammeter in the output stage as indicator. Components corresponding to those in Fig. 1 have the same numbers. The preset components in the top left corner are for enabling full gain to be used in the 50 c/s band without mains interference.

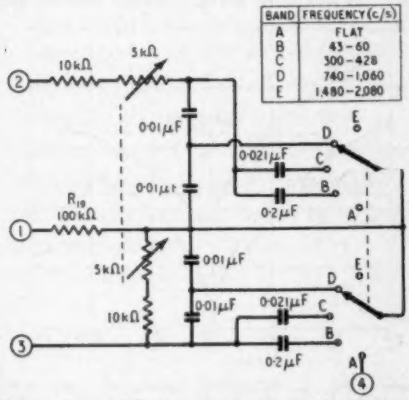
A still smaller valve, taking far less heater current (0.2 A instead of 0.7 A) is the EL42; and for these reasons it was used, with some slight sacrifice of performance.

A suitable octal first-stage valve for low noise and hum is the EF37A; the B8A equivalent is the EF40. Almost any double diode can be used for the a.g.c. rectifier. A pair of Westectors worked quite well, but with some loss of sensitivity, and possible risk owing to the high peak voltages liable to appear, so were not retained; and the germanium diodes obtainable were rather too low in backward resistance.

When the signal level is large, so that the valves are nearly cut off, the output waveform is a negative-going pulse, which is largely ineffective for producing negative a.g.c. bias if a single diode is used. The voltage-doubling circuit shown uses this pulse and greatly improves both sensitivity and a.g.c. characteristics. It will be noted that in the "meter" circuit (Fig. 2) there is the minimum of time-delaying smoothing between this rectifier and the grid of the output valve, the object being to secure a momentary upward or downward indication on the meter whenever the bridge is adjusted, before the bias has time to reach the previous stages and make the a.g.c. fully effective. In the "eye" circuit the indicator is necessarily the second stage, so the visual "transient" is not quite so marked, though of course the audible effect is the same.

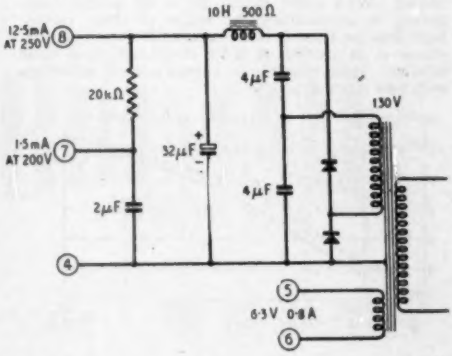
At frequencies of 50 c/s and below, one has to provide against feedback via the a.g.c. line causing slow oscillation. To avoid having to make the a.g.c. unduly sluggish, it was necessary to cut down C_4 and C_6 to 0.01 μF, causing the increase in feedback at low frequencies to be offset by a decrease in gain. It was for stability, too, that it was found desirable not to make use of the extra gain that could be obtained by transferring C_6 to a_1.

The frequent choice of 0.8 MΩ was occasioned by an ample stock of that value; there is no reason to suppose that substitution of 1 MΩ throughout would have any drastic effect. One resistor whose value really is critical, however, is R_4. It controls the shape of the a.g.c. curve; and to obtain a satisfactory sensitivity to small signals, combined with a steady



Above: Fig. 3. Tuning circuit covering four selected frequency bands as an alternative to a flat characteristic. Typical selectivity curves shown in Fig. 5.

Below: Fig. 4. A suitable power unit. The centre-tapped voltage-doubler selenium rectifier is rated at 260 V, 30 mA output.

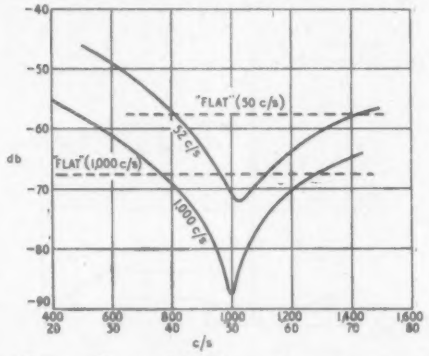


slope and no reversal at large signal amplitudes, it is advisable to ascertain the best value by using a variable component initially.

So effective is the a.g.c. that a manual gain control was omitted, but if the bridge introduces a large amount of hum it is desirable to shunt the input by the lowest resistance that leaves sufficient signal; for the selectivity is effective only at low signal inputs, so can be swamped if the interference level from the bridge is substantial.

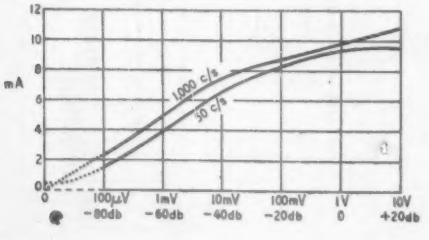
Direct connection to the detector terminals of the bridge necessitates one of them being "earth." The modern trend is towards T networks and inductively coupled bridges, in which both source and detector can be earthed, but where this is not the case and it is necessary to connect one of them through a suitably screened transformer it is generally simpler to make it the source, as a detector transformer may need a Mumetal screen in addition, to exclude hum.

Seeing that audible indication is not primarily relied upon in the 50 c/s band, there is hardly any limit to the cheapness of the output transformer that can be used. Its impedance at the higher frequencies is limited by a 10 kΩ shunt, so that the signal current through R_{12} and R_{14} does not vary widely with frequency. It should be noted, however, that the step-down ratio should be quite large (say 90:1 for a 2-Ω speaker) to minimize the effect of loudspeaker connection on feedback and frequency. The voltages across R_{13} and R_{14} provide negative and positive feedback respectively when a fraction of them is applied to the cathode of the first value via R_{19}. The Wien frequency-selective system (Fig. 3) causes negative feedback to prevail except at and near the frequency to which it is "tuned," when the feedback is positive and can be adjusted close to the oscillation point by R_{14}. As Fig. 5 shows, the sensitivity at the chosen frequency can be increased up to about 20 db, and decreased substantially at frequencies well off tune, giving a very useful discrimination against harmonics and bridge noise.



Above: Fig. 5. Selectivity curves at two spot frequencies, with the feedback control at a stable setting, showing input required to give 1.5 mA deflection. Decibels are reckoned from 1 volt as zero. The "flat" gain in the 50 c/s band is deliberately less, to avoid instability via the a.g.c. line.

Below: Fig. 6. Automatic gain control curves, showing downward deflection of meter in the Fig. 2 circuit. With either circuit R_8 is the critical component in determining the shape of these curves. Note that the slope is rather steeper for small signals, where it is needed to give clear indication near balance. Hum interference caused a small deflection with zero input at 50 c/s.



Use of a double triode introduces one disadvantage to set off against a certain amount of simplification and economy; in all of those tried there was a substantial amount of hum—of the order of 1 mV under working conditions—due apparently to internal capacitance between heater and grid leads. It could not be suppressed sufficiently by the usual potential divider only (R_{17}) and seriously reduces the usable sensitivity in the 50 c/s band. It is true that the beat effects can be removed by using the mains also as bridge source, but, thus hidden, the hum is even more undesirable, because in general it causes an apparent balance which is off the true balance and so leads to errors in measurement.

At the cost of a little elaboration the hum can be balanced out if R_{17} is supplemented by a phasing device consisting of C_{21}, R_{18} and C_{19}. The latter component is a pre-set capacitance of a few pF (say 1-5) and R_{18} can either be a pre-set variable, or fixed after the correct value has been found by trial with a variable. These adjustments can be made very precisely by feeding in rather less than a millivolt of signal at about 52 c/s and adjusting for minimum slow beat.

Tested on a wide variety of bridges, the amplifier has proved its worth. It is particularly valuable for measurement of inductance, giving a really sharp balance under conditions where 'phones are practically useless. The irritation of having to wait until each incredibly slow aircraft has gone is completely removed, and it is a great pleasure to be able to do anything to the bridge without fear of one's ears being shattered. With the selectivity in use, discrimination against harmonics is so effective that the source can be switched from "Sine" to "Square" almost unnoticeably.

It is, of course, essential to enclose the amplifier (excluding the power unit) in a screened box, and the grid input lead from the bridge must be screened. For the indicator in the Fig. 2 version the largest available milliammeter was obtained (actually an ammeter with the shunt disconnected) and the original dial replaced by a blank one marked as boldly as possible with arbitrary scale divisions so that the movements of the pointer can be seen easily without having to be close to it.

NEWS!

BRIMAR

announce the development of

a high-reliability range of valves

BRIMAR

In response to the ever-increasing demand from the Services and from Industry for valves having a guaranteed minimum life, Brimar have developed a strictly limited range to cover a wide field of application. Nominal characteristics and base connections will be identical to those of existing types. Development work may therefore be undertaken using available supplies pending availability of the new Trustworthy range.

★ Improved mechanical design

★ Special processing

★ Tested for shock, fatigue, resonance and vibration

★ Inspection by microscope

for TRUSTWORTHY

BRIMAR VALVES

TRADE MARK

Watch *for further news of this new range!*

STANDARD TELEPHONES AND CABLES LIMITED FOOTSCRAY KENT

high fidelity

MICROPHONES

FOR PUBLIC ADDRESS, RECORDING, AMATEUR RADIO

TYPE MIC 22

This model incorporates the famous Acos "Filtercel" insert giving extreme sensitivity and high fidelity. Response is substantially flat from 40-6,000 c.p.s. The microphone is vibration and shock proof and is not affected by low frequency wind noises. Two alternative mountings are available for the MIC 22 head :—

MIC 22-2 is supplied as a complete unit incorporating an attractive desk stand with cable side entry.

MIC 22-1 is for fitting to any British or American type standard floor stand and can also be used as a hand microphone.

PRICE £6. 6s. *(Either Model)*

TYPE MIC 16

Incorporates the Acos Floating Crystal Sound Cell giving a response substantially flat from 30-10,000 c.p.s. Performance is unaffected by vibration or shock and low frequency wind noise. As in the case of the MIC 22, two alternative mountings are available for the MIC 16 head :—

MIC 16-2 is a complete desk stand unit with cable side entry.

MIC 16-1 is ready for fixing to either British or American type floor stands by means of a knurled ring.

PRICE £12. 12s. *(Either Model)*

COSMOCORD LIMITED, ENFIELD, MIDDX.

LETTERS TO THE EDITOR

The Editor does not necessarily endorse the opinions expressed by his correspondents

Valve Symbols

IN the January issue of *Wireless World* "Diallist" regrets that the preamble to BS1409:1950 suggests that the valve symbols contained therein "are intended for use mainly in manufacturers' catalogues and such like," whereas he would vastly prefer that they should be adopted by "all British writers, teachers, . . . " etc.

Now this is a very laudable ideal, but is unfortunately impossible of fulfilment. The main reasons for this state of affairs are, I would suggest:

(1) The symbols are intended to cover nearly all the contingencies which can arise in the specification of multi-electrode valve parameters and are, on that account, somewhat complicated, double suffixes being very common. Multiple suffixes are the very devil in printing and duplication processes and few teaching establishments could cope with the preparation of literature using such symbols.

(2) The symbols are specifically designed to define the characteristics of any single valve. However, we must, of necessity, use the valve with its fellows and it is here that the difficulties of the system are most apparent.

For example, if we consider the problem of describing the passage of a signal through a multi-stage amplifier in terms of the circuit parameters, we would be mainly concerned with control grid and anode voltage variations. In such a description we would normally define a system of symbols; e.g., let voltage on grid of V_1 be v_{g1}, let voltage on grid of V_2 be v_{g2}, and so on.

If, however, we use the B.S. symbols we must resort to the clumsy device of specifying the particular valve on each occasion; thus v_{g1} of V_1, v_{g1} of V_2, etc.

(3) It is almost impossible to use the symbols algebraically in the derivation of an expression. To prove this conclusively, it is only necessary to apply the symbols to, say, the determination of the unbalance expression for a see-saw phase-splitter or to the operating equations of a sanatron time-base.

(4) My personal grudge, from a teaching point of view, is that it is no longer possible with this system to speak unambiguously of "the R_a of the valve"; in oral teaching it becomes necessary to distinguish between the a.c. resistance and the external load.

The introduction of a standard system of symbols for specification purposes is itself a major advance which will be welcomed by all right-thinking electronic engineers. If, however, the system is called upon to shoulder a burden for which it was never designed, we run a grave risk of obscuring its undoubted merits for its original purpose.

The B.S. Committee is therefore quite right to place a restriction on the recommended applications of the symbols.

At Sea. E. JEFFERY.

American Insularity

HAVING recently had the opportunity of several discussions with American engineers and technicians in the electronic field, I was particularly interested by the recent letter, by A. T. Colbeck, in the November, 1950, issue. In most of these discussions I was surprised by the small extent to which our trans-Atlantic colleagues were aware of British efforts in the fields of radar and telecommunications. Investigation showed, however, that this could in no wise be attributed to insularity on the part of the individual but rather to the lack of information presented to him during his perusal of technical literature. Indeed, individuals to whom I spoke were only too ready to give praise, where praise was due, to that British work with which they were familiar.

This state of affairs has arisen, in my opinion, by virtue of the high degree to which America has cultivated the art of advertisement. By comparison, articles dealing with our own progress, published in the technical press of the United States, stand a good chance of being overlooked. Let us hope that the advent of the Festival of Britain, together with the 1951 Radio Exhibition, will do much to change the position. A. CRIBB.

R.E.M.E., Korea.

I AM an Englishman living in this part of New York, and I think that you might be interested in an experience which I had last night. I took my small boy's radio in to my local dealer, for overhaul. The repairman worked on it, and we chatted together. He told me that he was in London during the war, and that he was a subscriber to *Wireless World*. The talk got on to international relations, and we agreed how much better it would be if the papers of our two countries stopped criticizing so much, and gave each other a little credit for our accomplishments, whatever they may be. By that time he had finished with the set, and had put in a new valve, but he refused to take any money for what he had done. "Chalk it up to international relations," he said. That, I would like to say, is the spirit that is needed in these days, not only between our two countries, but, between all countries. I would like you to print this letter, if possible, not only to increase mutual understanding, but to let him know, when he reads it, that his action, and the thought behind it, was not unappreciated.

TERENCE R. BOND.

East Meadow, New York, U.S.A.

[This letter seems to sound a note on which correspondence on this subject may appropriately be closed.—ED.]

Radio in the Jungle

I HAVE read the interesting article by "Pronto" in the February issue and agree with the fundamentals. During the last war I was engaged on communications of this kind in India and Burma, when it was clearly evident that no existing military sets were suitable for the task. Either the lightweight sets had very reduced range, especially on R/T, because normally speech is not required to have long range, or the larger sets could have met the requirements for signals, but were too heavy to be used in the field.

Efforts were made to provide special sets for this purpose associated with hand generators; these generators which had h.t. and l.t. windings, providing d.c. up to 70 watts total, were found suitable, particularly for transmitting. A type GN58 manufactured with regulator for the American Signal Corps was satisfactory and weighed about 30lb, made up of:—generator 22lb, legs, cranks, etc., 8lb. Although this is fairly heavy it compares favourably for life, weight and volume with equivalent power derived from dry batteries, which are not reliable under tropical conditions. While it is agreed that pedal generators are fatiguing after a day's march, it is relatively easy for two people to turn the hand generator—one on each handle. Also the hand generator could be clamped to a tree at suitable height. It is felt that serious consideration should be given to the design and use of this source of power.

Concerning the aerials for communications with 6 watts and up to 200 miles, on the frequencies 2 to 10 Mc/s, we found that the most successful type was the $\frac{1}{2}$-wave dipole, although the $\frac{1}{4}$-wave end-fed was reasonable, the former type appeared to give better transfer of r.f. power with more consistent results.

For this type of set it is considered that 5 watts output is necessary for communication with the above conditions. Experience showed that reduction below 5 watts

gave serious deterioration under many conditions, while increasing it to 10 watts did not give much noticeable improvement.

Coventry, Warwickshire. D. R. SABEN.

Capacitors in See-Saw Circuit

ALTHOUGH the use of capacitors instead of resistors in a See-Saw Circuit is mentioned by Cocking* and others†, it is the writer's opinion that the advantages of using them are not fully appreciated. These advantages are:

(1) Capacitors having a tolerance of ±1 per cent are easily and cheaply obtainable while resistances cannot normally be produced to this tolerance.

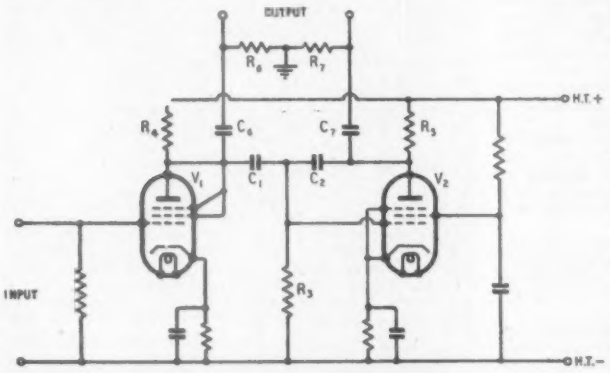
(2) No adjustable member (e.g., a potentiometer) is required and therefore the cost is reduced and maladjustment cannot occur.

(3) The short- and long-term accuracy of the amplitude balance is increased because of the reduced tolerance and avoidance of maladjustment.

(4) The phase balance is excellent.

The circuit details are shown in the figure, in which the following component values may be employed: C_1, C_2, 100$\mu\mu$F; R_3, 3MΩ; R_4, R_5, 10,000Ω.

With these components the phase balance is zero at frequencies from 50 c/s to 10 kc/s while the error at



20 c/s is only 20 degrees provided that the impedance of the output coupling network R_7 C_7 is high compared with that of R_5. The values of R_6 and C_6 should be the same as those of R_7 and C_7 in order to preserve the anti-phase condition. Although the phase of the potential at the anode of V_1 is altered by the addition of R_6 C_6, it remains a reference potential and that at the anode of V_2 will be in anti-phase, at least for the upper frequencies, in the absence of R_7 C_7. Careful design of this latter network can reduce the inevitable error to negligible proportions.

J. K. DRAPER.

E.M.I. Engineering Development, Ltd.,
Hayes, Middx.

* W. T. Cocking, *Television Receiving Equipment*, 1st edition, p. 51.
† Cosmos Report R.1730, October, 1937.

Cathode Follower Circuit

ALTHOUGH the cathode follower has had many applications, I have not seen it used following a diode detector, where, under certain conditions, its use may justify the expense of an extra valve. The advantages are, of course, its high input and low output impedances. This means:

A.C. shunting of the diode load resistor is virtually eliminated, with a consequent reduction of distortion. If the cathode follower grid leak is 1MΩ, then the input impedance may approach 10MΩ.

The diode load can be chosen high enough to give good detector efficiency, without raising serious a.c. shunting problems.

A relatively low value of potentiometer can be used for gain control across the cathode load. (Make sure the time constant CR is adequate). This is helpful when variations of high-frequency response at different volume control settings are encountered with conventional values, particularly when a high capacity circuit is being fed. This is often unavoidable if long screened leads are used.

London, N.8. S. H. FINN.

Electrical Dangers

I WAS both pleased and surprised to read Mr. Crampin's letter in your February issue. I have made a study both of electric shock and electric safety and I am pleased that a low supply voltage for domestic use was advocated in the letter. The need for a value around the 100-volt mark for alternating current supplies is easily seen from statistics of accidents in factories.

To say that anyone can touch the element of an electric fire and so risk electrocution may be true, but I wish here to strongly disagree with Mr. Crampin about earthing. The reason for earthing the metal cases of electric appliances is well known and the precaution is sound, but if anyone can touch a current-carrying part the designer of the appliance is to blame. An appliance designed without regard to safety measures—including earthing—is a danger to the consumer and should be abolished. I believe that we in England have the most dangerous electric fires in the world, and unfortunately unlike members of our Commonwealth and the Scandinavian countries, we have no legal minimum standard of air heater design. More people are injured and killed each year by them than by gas and even coal fires. For this reason, the appearance of a special safety electric fire, made by Ferranti, has been most welcome to me and I sincerely hope that other firms making fires—safety or otherwise—will try to equal its specification.

T. J. WYNN.

Bradford, Yorks.

Television Relay Loss

REFERRING to Mr. Lawson's letter on this subject in the December, 1950, issue: At a recent meeting of the British Institution of Radio Engineers I myself raised the same query, and was answered to the effect that the television broadcast from the Radio Exhibition at Castle Bromwich was transmitted down the link to Alexandra Palace, thence back to Sutton Coldfield for transmission to Midland viewers. The signal, therefore, traversed the link *twice* before Midland viewers received it. Apparently the excellent picture quality was due to the use of new cameras of the latest type.

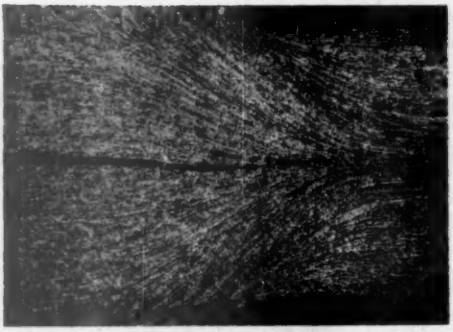
Another point apparently not common knowledge is the fact that the radio link is not now being used and that television programmes are transmitted between London and the Midlands by means of the underground co-axial cable.

G. L. HARRY.

Leamington Spa,
Warwicks.

Jointing Aluminium

Versatile Low-Temperature Methods Requiring No Flux

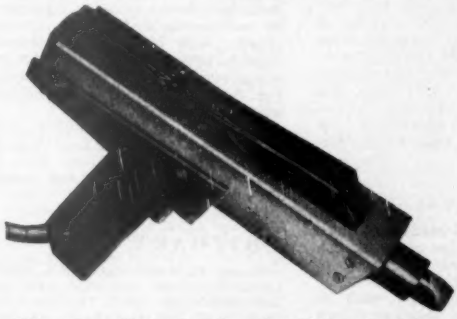


Microphotograph of a cold pressure weld, the pressure having been applied to the right of the shoulder.

ALTHOUGH aluminium is probably one of the most useful metals in the radio industry, it has always suffered from the disadvantage of being rather difficult to join. Admittedly the established methods, such as brazing, oxy-acetylene-, arc-, resistance- and spot-welding are, up to a point, satisfactory, but all require the application of considerable heat and this is not always a good thing in certain kinds of work. It is, therefore, of some interest that two new low-temperature methods have recently made their appearance in Britain—both, incidentally, coming from radio and electrical companies.

The first is cold pressure welding, developed by the Research Laboratories of the General Electric Company, for making homogeneous welds solely by pressure at room temperature. No flux is used, the tools are simple and inexpensive and no special machines are needed beyond those commonly found in industrial machine shops. The process merely involves pressing the two pieces of aluminium together until they flow at the surfaces; then the molecules of the separate pieces come into such intimate contact that they run together and form a true weld.

Careful cleaning of the two surfaces is, of course, necessary to achieve this and scratch-brushing has been found the most suitable method. It is interesting to note, however, that there is no such thing as an indifferent weld caused by contamination: either the metal is perfectly clean and there is a perfect weld or it is dirty and there is no weld at all. Also, it is immaterial whether the requisite pressure is applied as a slow squeeze or a sudden impact. Another feature is that the electrical conductivity of a pressure-welded aluminium joint is not less than that of a solid aluminium member of equal cross-section.



Ultrasonic soldering iron for soft-soldering aluminium.

Pressure welding is remarkably versatile, and a variety of different joints can be made by the use of dies specially designed for them. It is possible, for instance, to spot-weld by a series of indentations, to join perimeters by a ring weld, to make tubes for aluminium-sheathed cable by a continuous seam weld, and to join aluminium wires and meshes. The process is also successful with copper, and aluminium-to-copper welds can be made with equal facility.

Soft-soldering of aluminium is the other new low-temperature method of jointing, and this has been made possible by the ultrasonic soldering iron developed by Mullard Electronic Products. Hitherto, the difficulty with soldering aluminium has always been the highly refractory film of oxide which forms so easily on the metal and prevents the solder from flowing. Fluxes that react with the oxide have been tried, but are not very successful as the film re-forms immediately after the reaction has ceased. With the ultrasonic soldering iron, however, the oxide film is broken up by a 20-kc/s vibration coming from the soldering bit itself, after which the solder flows on to the metal in the usual way. The removal of oxide by this method is so effective that no flux is required at all. The same principle can be applied to the tinning of aluminium by immersion, only here the ultrasonic power energizes the bath of molten solder and, through this, attacks the oxide film as soon as the metal is dipped.

For generating the necessary ultrasonic power the soldering iron employs a magneto-striction transducer. This consists of a stack of iron-alloy laminations wound with two coils, one of which, the driving coil, is connected to the output of an amplifier, whilst the other, the pick-up coil, is connected to its input. Thus a feedback loop is formed with the soldering iron as an integral part of it, and oscillations at the natural frequency of the magneto-striction element are maintained by the gain of the amplifier. Ultrasonic vibrations generated in this way are then conducted by a solid bar to the soldering bit, which is made of nickel silver and is heated by a resistance-wire element in the usual way.

There is also a fluxless method of tinning aluminium with solder of 90% tin and 10% zinc, but the metal has to be cleaned very carefully and the result is not always satisfactory.

WORLD OF WIRELESS

B.B.C. Cuts • Radar Claimants • "Sound" Shows • Standardization

Television Regress

IT was announced by the Postmaster General in the House a few weeks ago that in view of the present defence programme it had been decided to postpone indefinitely the building of the five low-power television stations planned for Southampton, Plymouth, Newcastle (Pontop Pike), Aberdeen and Belfast. The remaining three high-power stations at Holme Moss, Kirk o' Shotts and Wenvoe will be completed as planned.

B.B.C. expenditure during 1951 on extending the television service has been estimated by the P.M.G. to be approximately £215,000, whilst the Post Office will spend some £350,000 in providing the necessary radio and cable links.

The original estimated expenditure of the B.B.C. on the development of television during the next three years was £4.25 million. This will now be reduced.

Radar Claims

PRIOR to the opening of the public hearing of the radar claims by the Royal Commission on Awards to Inventors on April 11th, the chairman and members of the Commission visited the R.A.F. Station at Bawdsey, Suffolk, the scene of the earliest radar experiments. The claims of Sir Robert Watson-Watt were heard first, and others submitting claims include A. F. Wilkins, Dr. E. G. Bowen, R. Hanbury Brown, Dr. A. G. Touch, Dr. K. G. Budden, D. Taylor, Wing Cdr. E. J. Dickie, Dr. B. J. O'Kane, W. A. S. Butement, P. E. Pollard, L. L. K. Honeyball, H. Dewhurst, R. H. A. Carter and Mrs. G. F. Herd.

The hearing will be continued from May 22nd to 25th and, if necessary, in June.

W. F. TAYLOR, O.B.E. (see "Personalities").

The 725-ft mast radiator of the new 150-kW Third Programme transmitter at Daventry is fed across an insulator at the 460-ft level by this open-wire unbalanced transmission line with four inner and eight outer conductors.

B.S.R.A.

TWENTY-TWO companies have again taken space at the exhibition of sound recording, reproducing and audio-frequency equipment organized by the British Sound Recording Association, to be held at the Waldorf Hotel, Aldwych, London, W.C.2, on May 19th and 20th. The exhibition will be open each day from 10.30 a.m. to 6 p.m.

Admission of non-members will be by programme, price 1s at the exhibition or 1s 2d by post from the secretary, R. W. Lowden, "Wayford," Napoleon Avenue, Farnborough, Hants.

A number of manufacturers will be giving demonstrations of high-quality disc, tape and wire recording and reproducing gear during the show.

Ignition Interference

IT will be recalled that in compliance with the provisions of the Wireless Telegraphy Act, 1949, an advisory committee was set up by the Postmaster General on July 26th last year to consider the question of ignition interference. Questions were raised recently in the House regarding the progress of the investigation and it was stated by the P.M.G. that the committee had met only twice—September 13th and November 17th—and had not yet made any recommendations.

British Standards

AS part of the celebrations to mark the golden jubilee of the British Standards movement, an exhibition, supported by practically the whole range of British industry, will be held at the Science Museum, South Kensington, from June 18th to 28th.

The benefits derived from standards, standardization and simplification will be graphically presented, and each industry will show how standards have simplified production, reduced costs and maintained quality, and how in turn they have benefited the users of that industry's products.

The exhibition will be opened at 11.30 on June 18th by the President of the Board of Trade. Admission to the exhibition, which will be open daily (except Sunday) from 10.0 to 7.0, will be free.

S.R.E. Exhibition

THE second annual exhibition and conference organized by the Association of Public Address Engineers will be held at the Horseshoe Hotel, Tottenham Court Road, London, W.C.2, on May 31st from 10.30 a.m. to 10.0 p.m. During the exhibition, which is being supported by twenty manufacturers, a demonstration will be given of sound-reproduction equipment used for an actual two-way transmission between the hotel and the liner *Caronia* some 600 miles out at sea.

Admission to the exhibition will be by ticket, obtainable free by bona fide sound technicians from Alex. J. Walker, 394, Northolt Road, South Harrow, Middx.

OBITUARY

George F. Mansbridge, O.B.E., whose name has been associated with the manufacture of fixed capacitors for many years (he applied for his first patent in this field over 50 years ago),

died on March 23rd, aged 83. He retired from the board of the Dubilier Condenser Co. two years ago.

PERSONALITIES

Prof. G. W. O. Howe, D.Sc., Technical Editor of our sister journal *Wireless Engineer*, will deliver the inaugural Clerk Maxwell Memorial Lecture during the television engineering session of the forthcoming Brit. I.R.E. Convention. This session, which will be held at King's College, Cambridge, from August 21st to 24th, is planned to embrace every aspect of television engineering from cameras to receiver design.

W. F. Taylor, O.B.E., director of the Telegraph Condenser Co., is the new chairman of the Radio & Electronic Component Manufacturers' Federation. He has been with T.C.C. since 1925, and during the war took over the management of the company's works at Acton and the various dispersal units which were established to boost production.

Harold Hunt, who has been with E. K. Cole, Ltd., since 1931 and in recent years has been engaged on the development of broadcast receivers and communication equipment, has been

HAROLD HUNT.

appointed chief of development and engineering, responsible to A. W. Martin, the company's chief engineer. Prior to joining the company he was successively with A. Reyrolle & Co. and in the research laboratories of H.M.V.

P. G. A. H. Voigt, B.Sc., A.M.I.E.E., who is now part-time instructor in electronics at the Ryerson Institute of Technology, Toronto, Canada, gave a demonstration of high-quality reproduction to the Wireless Association of Ontario on March 15th last. The equipment used included the American *Audio Engineering* version of the Williamson amplifier, Voigt moving-coil pickup with diamond stylus, and the latest Voigt rematched diaphragm loudspeaker with 22,000-gauss field magnet. Decca "London" records were used in the test. The audience, which filled the lecture hall to capacity, included Frank Murphy, who now lives in Toronto.

Charles I. Orr-Ewing, O.B.E., M.I., who was in charge of B.B.C. television outside broadcasts prior to joining A. C. Cossor, Ltd., as technical commercial adviser two years ago, has been appointed a director of the company. He is also a director of Cossor Radar, Ltd. Before joining the B.B.C. in 1938 he was with H.M.V.

Prof. John A. Ratcliffe, O.B.E., M.A., Reader in Physics at Cambridge University, who during the war was superintendent at T.R.E., has been elected a Fellow of the Royal Society. Prof. Ratcliffe was appointed a member of the Television Advisory Committee in 1949.

Morris Reed, Ph.D., M.Sc., M.I.E.E., who was appointed chief radio engineer of Mitcham Works, Ltd.—a subsidiary of Philips—in 1948, has been made a director of the company. From 1929 to 1946 he was with Siemens Bros., and for two years prior to joining Philips was general manager of R.F. Equipment, Ltd.

IN BRIEF

Licences.—An increase of 45,050 television licences during February is recorded by the Post Office. The total number of sound and vision licences current in the U.K. at the end of February was 12,376,300.

Performing Rights.—The question of fees charged for the public performance of gramophone records was recently raised in the House and the President of the Board of Trade stated in reply that the question of performing rights in recordings would be included in the general review of copyright which it is hoped to begin at an early date.

Amateur Exhibition. — The fifth annual amateur radio exhibition to be organized by the Radio Society of Great Britain will be held at the Royal Hotel, Woburn Place, London, W.C.1, from November 28th to December 1st.

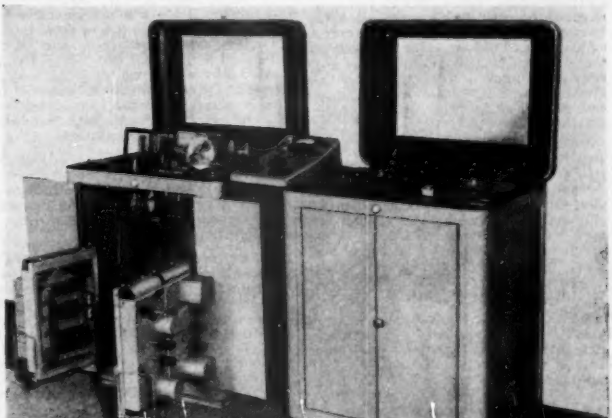
Zworykin Prize.—The American Institute of Radio Engineers announces that Dr. Vladimir Zworykin has given a prize which will be awarded annually for twenty years, beginning in 1952, to the member of the Institute who has made the most important technical contribution to electronic television during the preceding year.

Aeronautics.—A two-year course in aeronautical engineering, with special stress on the application of electronics in this field, has been arranged by the College of Aeronautics, Cranfield, Beds. The five main sections of the course, which begins in October with a yearly intake thereafter, are applied electronics, communications, aerials, servomechanisms and electrical systems.

T.I.D.U.—The Technical, Information and Documents Unit, which for a number of years has been attached to the Board of Trade, is now part of the Information Services of the Department of Scientific and Industrial Research. For the present the Unit will remain in Lacon House, Theobalds Road, London, W.C.1, where the large collection of unpublished German documents of technical interest and post-war American and O.E.E.C. reports can be inspected.

Electro-physiology. — The Electro Physiological Technologists' Association, formed about eighteen months ago to cater for those engaged in clinical and research work in electro-physiology (such as electro-encephalography), will be holding its annual general meeting on May 19th at Hurstwood Park Hospital, Haywards Heath, Sussex. Non-members are invited and can obtain particulars of the Association from the Secretary, G. Johnson, at Hurstwood Park Hospital.

"How Television Works" is the title of a new 10-minute film produced by G-B Instructional Ltd., of Imperial Studios, Boreham Wood, Elstree. Designed for the age group 13 upwards, it covers the link-up from studio to receiver photographically and explains the mechanism of scanning by means of animated diagrams. The fading of photographic pictures into working models, when explaining the pick-up tube and cathode-ray tube, is particularly well done. Although the treatment



SOVIET MAGNETOPHONE. Twin-console reproducers, each containing a two-stage recording amplifier and a three-stage play-back unit, produced in the U.S.S.R. and recently demonstrated in this country. Based on the German Magnetophon, it uses standard 6.5-mm tape, recording at 77 cm/s and has a frequency response flat within 1.5db between 50 and 10,000 c/s.

is not rigorous enough for technical students, the film provides an excellent introduction for the interested layman and would probably go down well as a B.B.C. television programme. It is available in 35mm (and 16mm in May) on one reel and can be hired for 7s 6d (for the first day) or bought for £12 10s.

Changing Outlook.—When speaking at the Radio Industries Club luncheon the Minister of Supply told this story. A four-year-old child taken to the cinema for the first time said, "Look, daddy; big television."

Jordan Telecommunications.—A long-term licence to operate a wireless telegraph station in Amman, Jordan, has been granted by the Jordan Government to Cable and Wireless, Ltd. A mobile station has been in operation in Amman since May, 1948, on a provisional licence and efforts are now being made to establish a permanent station in Jordan. The mobile station was transferred from Jerusalem prior to the surrender of the British Mandate in Palestine.

Navigation Prize. — Under the Thomas Gray Memorial Trust the Royal Society of Arts is offering a prize of £50 to any person of British nationality who may bring to its notice "an invention, publication, diagram, etc., which in the opinion of the judges is considered to be an advancement in the science or practice of navigation proposed or invented by himself in the period January 1st, 1946, to December 31st, 1951." Further particulars are available from the R.S.A., John Adam Street, London, W.C.2.

Veterans' Reunion.—The fifteenth reunion luncheon of Marconi veterans will be held at Caxton Hall, London, S.W.1, on May 5th. The luncheon will be followed by the annual general meeting.

Colonial Appointment.—The appointment of Edward J. K. Banks, B.Sc., as assistant controller of radio communications in Malaya is announced by the Colonial Office. Since 1949 he has been engaged on the development of e.h.f. transmitters with British Telecommunication Research, Ltd., prior to which he was successively at the G.E.C. radio and television works, Coventry, and at Plessey's where he was senior circuit and project engineer in the company's microwave laboratory.

"Communications Receiving Equipment."—All the reprints of the article giving modifications to the R1155 for civilian use (July, 1946), having been sold, the opportunity has been taken to combine with it two related articles on band-pass converters (October, 1950, and February, 1951). This 12-page reprint, "Communications Receiving Equipment," is now available from our Publisher, price 1s (postage 1½d).

R.E.C.M.F.—The chairman of the Radio and Electronic Component Manufacturers' Federation for the ensuing year is W. F. Taylor (T.C.C.) and the vice-chairman, P. D. Canning (Plessey). They succeed L. H. Peter and H. V. Slade respectively.

Indian Exhibition.—As announced last month, an international exhibition of radio and electronics is to be held in Bombay next February under the auspices of the recently formed Radio and Electronics Society of India. A delegation is visiting the Continent and this country to solicit the support of the radio industry. The delegates, headed by Y. A. Fazalbhoy, managing director of General Radio and Appliances, Ltd., of Bombay, were in this country during the R.E.C.M.F. exhibition and will be returning for a week on May 4th. They will be staying at the Savoy Hotel, London, W.C.2.

Y. A. FAZALBHOY.

Plastics Convention.—During the forthcoming plastics exhibition, organized by our associate journal *British Plastics*, a ten-day convention, planned to appeal to the technologist within the plastics industry, the users of plastics and the general public, will be held. The exhibition and convention open at Olympia on June 6th. A programme of the convention, giving summaries of the papers to be read, is obtainable from *British Plastics*, Dorset House, Stamford Street, London, S.E.1, from whom free tickets for specific sessions of the Convention and for the exhibition are also obtainable. Radio-frequency heaters are among the equipment being exhibited.

QSL Cards.—E. R. Martin (G2MN), of R. Martin & Co., Bridge Street, Worksop, Notts, who are producing the QSL cards for the amateur radio station, GB3FB, which will form part of the Festival of Britain Land Travel Exhibition, informs us that they are printing special QSL cards for the personal use of amateurs. On the face of the card is a view of the South Bank Exhibition overprinted with the call sign.

Metal Polishing.—Designers and production executives will be interested in the book "Industrial Polishing of Metals" recently published for our associate journal *Metal Industry* by Iliffe & Sons, Ltd., price 21s.

"By any other name . . ."—The Decca Radar house journal, which was introduced in May, 1950, under the title of *Decca News*, has been renamed *The Scanner*. The fourth issue, dated February-March, 1951, contains an article describing the Decca schools for training in operation and maintenance.

INDUSTRIAL NEWS

South African Agency.—F. P. Moore, a director of S.M.D. Manufacturing Co. (Pty), Ltd., of Natal, South Africa, is visiting the continent and the U.K. in an endeavour to secure machinery, plant and raw materials for the manufacture of small transformers and chokes and capacitors. The company is also interested in securing agencies for communications and radar equipment. Mr. Moore's address from May 9th to the end of June will be 18, Herringston Road, Dorchester, Dorset.

S.I.M.A.—Among the British radio and electronic instrument makers who will be exhibiting at the International Trade Fair at Toronto (May 28th—June 8th), where the Scientific Instrument Manufacturers Association has taken space, are:—Everett Edgcumbe, Fielden, Kelvin-Hughes, Southern Instruments and Tinsley.

R.F. Heater.—What is claimed to be the most powerful r.f. heater in Europe has been installed recently by Philips Electrical at de Havilland Propellers Ltd., Hatfield, Herts, for hardening purposes. It has a maximum output of 150 kW (continuous) and 200 kW (intermittent) and the nominal operating frequency is 275 kc/s. The valve complement of the equipment, which measures approx. 7 ft high, 4½ ft wide and 12 ft deep and weighs 3 tons, consists of an oscillator, grid bias valve and six rectifiers.

Partridge.—The managing director of Partridge Transformers Ltd.—Arthur L. Bacchus—is touring the United States where there has been a great demand for the company's products.

S.R.E.—In the note on the installation of Philips sound-reinforcing equipment in the Glasgow Banqueting Hall in our last issue mention should have been made of the fact that the work was carried out by C. W. Cameron, Ltd., of 59, Oswald Street, Glasgow, C.1.

MEETINGS

Institution of Electrical Engineers

Radio Section.—Symposium of Papers on the Sutton Coldfield television station: "The Sutton Coldfield Television Broadcasting Station" by P. A. T. Bevan, B.Sc., and H. Page, M.Sc.; "The Vision Transmitter for the Sutton Coldfield Television Station" by E. A. Nind, B.Sc. (Eng.), and E. McP. Leyton; and "Vestigial-Sideband Filter for the Sutton Coldfield Television Station" by E. C. Cork, B.Sc. (Eng.), at 5.30 on May 9th at the I.E.E., Savoy Place, London, W.C.2.

British Institution of Radio Engineers

London Section.—"The Resistance Wire Strain Gauge in the Measurement of Physical Quantities" by J. L. Thompson at 6.30 on May 24th at the School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1.

Merseyside Section.—Annual general meeting followed by a technical film "Atomic Physics" at 7.0 on May 4th at the Electricity Service Centre, Whitechapel, Liverpool.

North-Eastern Section. — Annual general meeting followed by a technical film at 6.0 on May 9th at Neville Hall, Institute of Mining and Mechanical Engineers, Westgate Road, Newcastle-on-Tyne.

Institution of Electronics

Midlands Branch.—"Some Recent Applications of Electronic Techniques in Industry" by R. J. F. Howard (British Electronic Products) at 7.0 on May 8th at the Warwick Room, Imperial Hotel, Temple Street, Birmingham, 2.

THE "BELLING-LEE" PAGE

Providing technical information, service and advice in relation to our products and the suppression of electrical interference

British Industries Fair.

This year we shall be exhibiting at the Birmingham section, Castle Bromwich, Electrical Group C, Stand No. C.710.

Those interested in H.F. screening may be intrigued by the office on the stand, which is in fact a screened compartment as illustrated.

Bearing in mind that most of our co-exhibitors are also customers of ours, we shall be exhibiting an extensive range of components used in electronic engineering, including a few types of air-borne dipoles and an odd television aerial as make-weight. We shall be exhibiting a horizontal dipole and reflector of similar construction to that used for Wrotham.

Horizontally polarised dipoles and reflectors have been designed for French Television, where optimum results are obtained on a folded dipole. We do not recommend such an arrangement for British Television for reasons well known to readers of this page.

The automatic aerial polar diagram plotter will also be demonstrated to those interested.

Method of measuring performance of television aerial, approved by D.S.I.R. and R.E.C.M.F. panel "K"

The basis of this method of measurement is the comparison of the sensitivity of the aerial under test with that of a single dipole. The polar diagram is also plotted. Both these tests are made at sound and vision frequencies.

The measurements are taken in open country, free from surrounding objects, the source of signal being an oscillator, and not one of the B.B.C. transmitters. The testing site is first explored with a single dipole to confirm the absence of standing waves. The dipole is then erected at a height of 35ft above ground level, and its output measured. This output becomes reference level for the remainder of the measurements.

The aerial is connected to the measuring set by a specific length of co-axial cable, having a characteristic impedance of 80 ohms. This feeder terminates in its own characteristic impedance, and is coupled to the measuring instrument through an attenuator. This ensures that the feeder termination is substantially resistive.

When the signal from the single dipole has been noted, the aerial under test is substituted for the dipole, and the measuring set read, all other conditions remaining unchanged. The aerial is rotated, and the azimuthal polar diagram obtained.

The response of the aerial is expressed in decibels referred to the response of the dipole. Comparative tests between aerials imply that the cable used in every case is of the same electrical specification; is of the same length, and follows the same run.

What type of Television Aerial?

This is probably the most common query arising out of the morning mail. Most of our readers here know that it just is not practicable to be definite about such a matter. Strangely enough, it is easier to be definite about "fringe" area aerials; put up the best you can as high as you can get it, and you know you cannot do better, but don't go to all that trouble and use inferior feeder cable.

The difficult letters to write are those dealing with bad spots a few miles from a transmitter, where, with luck, an indoor aerial should suffice, but where an outside "H" is necessary to obtain reasonable results, or worse still, where on account of cost, an outdoor simple dipole is installed, only to find that it is not good enough and that to the first cost, must be added an "H" type aerial, plus the cost of raising ladders a second time—no small matter. Do be advised by your dealer who should be aware of the possibilities and peculiarities of the district.

Inefficient Aerials.

A recent report stated that out of approximately 95,000 interference complaints investigated by the G.P.O. last year, 15,000 of these were due to the use of inefficient aerials.

We repeatedly stress that the aerial and its installation, should in every instance be considered a complement to the receiver, whether television or broadcast, and should not be dismissed lightly "as just another item," as no receiver will give of its best when fed from an indifferent or carelessly erected aerial.

In the case of "Belling-Lee" television aerials; both the "senior" and "junior" range are engineer designed, produced from high tensile light alloy, fully heat treated, with maximum thought given to such important points as stability and ease of erection. High winds do not adversely effect the elements, and the life of the aerials where regularly maintained, is exceptional.

For broadcast frequencies, the "Belling-Lee" "Skyrod" vertical anti-interference aerial is very effective in removing background noises, even in most severe cases of man-made interference, providing that the collector is outside the interference zone. When so employed, we recommend the use of a screened feeder, and where this is more than a few yards in length, the use of "Eliminoise" matching transformers is advocated.

Should you be a flat dweller or otherwise restricted for space, the "Belling-Lee" "Winrod," an easily fixed, window-sill mounting broadcast aerial, is well worth consideration. Whilst not claiming its performance is equal to a full-sized aerial, or that it cuts out interference as effectively as the "Belling-Lee" "Skyrod" or "Eliminoise" anti-interference aerial, it is a definite step in the right direction.

Will those in coastal towns, fishing ports, yachting centres etc., bear in mind that "Belling-Lee" are specialising in suppression on board ship. We have done such work on ships of all sizes from the "Queen" class to trawlers, driftors and yachts.

BELLING & LEE LTD
CAMBRIDGE ARTERIAL RD., ENFIELD, MIDDX., ENGLAND

10kV with a rectifier only 8.75" long

STANDARD engineers have achieved considerable progress in miniaturisation with their high voltage SenTerCel Tubular Selenium rectifiers. Take for example Type K3/140; only 8¾" long and ¾" in diameter it will provide a rectified output up to 10kV at 100 microamps across a capacitor of 0.005 microfarads in a pulse input half-wave arrangement.

Please ask for leaflet F/SRL 11

Two ranges of tubular rectifiers are available having rated current outputs of 1mA and 5mA in ambient temperatures up to 55°C. Each range includes stacks capable of withstanding a peak inverse voltage of 68V to 13.6kV per stack with a sinusoidal input.
Due to their low cost, they are ideal for use in television receivers and are eminently suitable for all other types of low current E.H.T. supplies.

SELENIUM
SenTerCel
RECTIFIERS
REGISTERED TRADE MARK

Standard Telephones and Cables Limited RECTIFIER DIVISION
Registered Office: Connaught House, Aldwych, London, W.C.2
Warwick Road, Boreham Wood, Herts. *Telephone: Elstree 2401. Telegrams: SenTerCel, Borehamwood*

Trends in Components

Survey of the R.E.C.M.F. Exhibition

The annual private exhibition of radio components and accessories, organized by the Radio and Electronic Component Manufacturers' Federation, was held in London from 10th-12th April. Our description of exhibits in each category is followed by a list of makers.

CAPACITORS

ALTHOUGH nothing startlingly new in capacitors was seen this year, it does not follow that development in this field has come to a standstill. One had to look a little more deeply to appreciate the full significance of the improvements embodied in the 1951 production programme.

Some new models there are, of course, the Polar (Wingrove and Rogers) type C90 variable capacitors being an example. This unit is made in two- and three-gang types and is mounted in a sturdy "U"-shaped cadmium-plated frame without lateral supports. The vanes are aluminium, the spindle is brass and the insulation ceramic. Ball bearings are used front and back and a revival of an earlier idea is the inclusion, as a built-in feature, of a 6-to-1 ratio epicyclic drive. In the latest model the drive is embodied in the front bearing so that concentric spindles are not required. These new capacitors are made with or without the reduction drive and in capacitances up to 528 pF swing.

A new method of sealing fixed capacitors has been developed by the Telegraph Condenser Co. It is described as "Plimoseal," and the capacitor, be it moulded mica, tubular or metal-cased, is dipped in the compound which sets glass hard and is impervious to moisture.

Some new ceramic dielectric trimmers have been added to the Erie range of components. They have chassis-fixing bushes and are made in 1-12pF with a positive coefficient of temperature and 3-50pF with a negative coefficient. They are fully tropicalized.

Sydney S. Bird (Cyldon) has introduced a small insulated mica dielectric compression-type trimmer capable of operation at moderately high voltages, such as are met with in television sets to-day. It can be panel mounted as it has a moulded adjusting knob and is made in capacitances up to 1,000 pF for 1,500 V d.c. and up to 3,000 pF for 250 V d.c. working.

Changes were slight in most other directions. Daly had a new range of small etched-foil electrolytics in PVC-covered metal cases. Dubilier had a television suppressor unit consisting of two 500pF capacitors and two r.f. chokes assembled as a compact unit for fixing to small domestic electrical appliances. A somewhat similar device, but for inserting the mains lead to the appliance, was shown by the Telephone Manufacturing Company.

Makers*: Bird (T, V); British N.S.F. (P); Bulgin (T); Daly (E); Dubilier (C, E, M, P, T); Erie (C); Hunt (E, M, P); Jackson (T, V); London Electrical Manufacturing (C, M); Mullard (T); Plessey (E, T, V); Stability Radio (M); Static Condensers (P); Telegraph Condenser Co. (C, E, M, P, T); Telephone Manufacturing Co. (M, P); Walter Instruments (T); Wego (C, M, P); Welwyn Electrical (T); Wingrove & Rogers (T, V).

**Abbreviations:* C, ceramic; E, electrolytic; M, mica; P, paper; T, trimmers and preset, V, air dielectric variables.

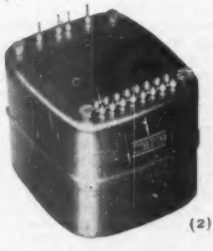
COILS AND TRANSFORMERS

Radio Frequency.—Few changes in the design of r.f. coils are noticeable and both air- and iron-cored types are still manufactured. I.F. transformers are normally individually screened but signal- and oscillator-frequency coils are more usually only partly screened and that in groups. Although quite commonly fitted as individual items to a receiver, a sub-assembly is sometimes used for the tuner. This usually incorporates the coils, trimmers, switches and interstage screening; types for two to nine wavebands were shown by Weymouth.

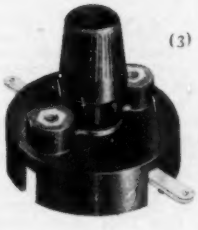
Wright & Weaire were showing a range of coils which depart considerably from the normal practice. Silver-plated wire is moulded on the inside of an alcothene former on the outside of which any coupling coils are wound. An adjustable contact

(1) The latest Daly miniature electrolytic of 25uF/25V size with PVC outer covering. (2) Partridge Transformers output transformer. (3) Miniature insulated compression type mica trimmer made by Cyldon. (4) Although very little larger than a matchbox, the Polar C9002/12 twin capacitor gives 2 × 528pF capacitance swing and embodies a 6 to 1 reduction drive.

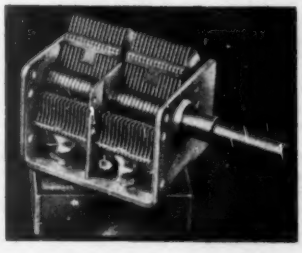
(1)



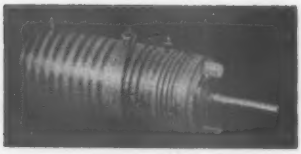
(2)



(3)

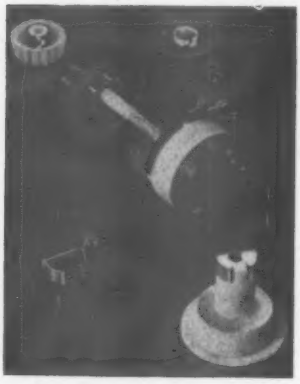


(4)



Wright and Weaire short-wave coil wound inside the former.

Ring and D-shaped clips by Simmonds Aerocessories, providing frictional connection between control knobs and their shafts.



to the inner winding is provided by an alcothene plug carrying a silver contact.

The general tendency with television r.f. coils is to adopt iron-dust-core coils individually screened. Small square cans are used which are little bigger than a modern miniature valve and in the coupled-circuit types the trimmers are accessible one from above and the other from below the chassis.

Makers: Advance, Automatic Coil Winder, Igranic, Oliver Pell, Plessey, Weymouth, Wright & Weaire.

Mains and A.F.—The use of C cores using grain-oriented material is increasing and Partridge Transformers showed a range of a.f. transformers embodying this technique. An output transformer in the C.F.B. series is claimed to introduce only 0.05 per cent distortion when handling 16 W at 50 c/s. Types with a bandwidth of as much as 15 octaves were shown.

This form of core is also used in the Ferranti H series of transformers and chokes which are made for 50-c/s use in sizes up to 1 kVA. They conform to the Inter-Services Specification RCS214. The Parmeko Neptune series also conform to this specification and also have C cores. A saving of up to 30 per cent in volume and weight as compared with shell-type cores is claimed.

Impregnation is now generally adopted and hermetic sealing is used for quite a number of types.

Makers: Acoustic Products, Advance, Automatic Coil Winder, Bulgin, British Electric Resistance, Electro Acoustic Industries (Elac), English Electric, Ferranti, Goodmans, Igranic, Partridge & Mee, Partridge Transformers, Plessey, Rola, Taylor, Truvox, Oliver Pell, Vitavox, Wright & Weaire, Weymouth, Woden.

RESISTORS

MOST of the work carried out on resistors appears to have been directed towards improving the stability of the various carbon types now in current use. It is difficult to itemize these improvements, as many are quite slight and entirely undetectable, yet they reflect in the long-term performance of most of the makers' products.

There have been some investigations by Painton into the stability of the higher ohmic values of the high-stability type resistor. This, it will be recalled, uses a carbon film deposited on an insulator of some kind, glass or ceramic being the most popular.

A new development is a wire-wound resistor on an oval former, it being claimed that more of this shape can be packed into a given area than is the case with circular types. Various finishes are employed, British Electrical Resistance use vitreous enamel, while Erie adopt a "Silvertex" coating which is a silicon base enamel said to have the protecting properties of vitreous enamel, but baked at a lower temperature.

Interference suppressor resistors for motor cars have been given some attention by Morganite and a number of newer types are now available. Standardization in ohmic values, at 5,000, 10,000, 12,500 and 15,000 ohms, for the various models should help production generally.

Makers*: Advance (A); Belling-Lee (S); British Electrical Resistance (P, V, W); British N.S.F. (P); Bulgin (P, W); Colvern (P, W); Dubilier (C, HS, M, P, S, V); Egen (P, W); Erie (C, P, S, W); Igranic (W); Morganite (C, P, S); Mullard (HS, NC); Oliver Pell Control (W); Painton (A, HS, P, V, W); Plessey (P); Standard Telephones (A, NC, S); Taylor (P, W); Welwyn Electrical (HS, V, W).

**Abbreviations:* A, attenuators; C, composition; HS, high stability; NC, negative coefficient; P, potentiometers; S, suppressors; V, vitreous; W, wire-wound fixed and variable.

VALVES

IN view of recent criticisms on the unreliability of valves, it was interesting to note the appearance of a range of "trustworthy" types specially developed by Brimar for use in aircraft, telecommunications, instruments and Service equipments. Improvements lie mainly in better mechanical construction and more rigorous testing, so that by reducing the likelihood of mechanical failure the valves have been given a higher expectation of life.

Prominent among cathode-ray tubes was the new English Electric steel-bodied tube T901, shown here for the first time. It has a 16-inch screen, 6.3-V heater, 14 kV on the anode and a deflection angle of 70 degrees. Tubes with rectangular screens were the other main development and examples were shown by Brimar and Ferranti.

The idea of mounting quartz crystals inside valve-type envelopes has been taken a step further by Pye, who showed a miniature crystal oven with the crystal, heater and thermostat all contained in an evacuated B7G envelope. On the S.T.C. stand was a crystal for working at the unusually high overtone of 100 Mc/s.

Makers: Edison Swan, Ferranti, General Electric Company, Mullard, S.T.C.

METAL RECTIFIERS

TELEVISION applications figured prominently in the displays of metal rectifiers this year, and emphasis was placed on the use of low-current tubular types for e.h.t. supplies. S.T.C. showed a new selenium range of considerably lower price and smaller size than previously produced, with inputs up to 17 kV, current ratings of 1 and 5 mA and alternative wire or screw connections. Westinghouse featured the well-known 36EHT and 36K ranges and also showed their 16HT and 16K models which provide for low-current applications up to 4,120 volts.

The trend towards smaller h.t. rectifiers was reflected in the appearance of a new addition to S.T.C.'s RM range, the RM0, which measures only $\frac{7}{8}$in × $1\frac{3}{8}$in. It is designed primarily for use in television preamplifiers and similar equipments and is rated at 125 V input and 30 mA mean d.c. output when used for half-wave rectification.

Makers: Salford, S.T.C., Westinghouse.

TELEVISION COMPONENTS

THE use of Caslam in television scanning components has now been extended to deflector coils, and Plessey showed types having a magnetic circuit of this material. Being a solid, it lends itself to easier assembly than laminations and its low losses make it suitable for "efficiency" scanning circuits. Another solid for the same purpose is Ferroxcube, which was shown by Mullard, while Salford exhibited Gecalloy dust-iron.

Permanent and electro magnets for focusing were to be found on the Plessey stand and the former were also shown by Eclipse and Electro Acoustic Industries. Two models of Elac ion-trap magnets were shown, for Cossor and Mullard tubes.

Moulded plastic implosion guards were exhibited by Thermo-Plastics, while Long and Hambly showed c.r. tube masks having a lacquer finish.

Makers: British Moulded Plastics, Electro-Acoustic Industries (Elac), Igranic, Long & Hambly, Mullard, James Neill (Eclipse), Plessey, Salford Electrical Instruments, Thermo-Plastics.

SWITCHES AND RELAYS

APART from a new s.p. toggle-switch with a neon indicator matching its appearance (Diamond "H" Switches) very little has occurred in this field since last year. However, the "Ledex" rotary solenoid made by N.S.F. still continues to attract a great deal of attention because of its unusual screw principle. This is an electromagnetic mechanism of considerable power and efficiency which can be arranged to turn a large bank of rotary switch wafers in sharp positive steps. Another popular favourite, also shown last year, was the "Minibank" rotary switch, made by AB Metal Products. It measures only $\frac{3}{4}$in (diameter) by $1\frac{3}{32}$in (depth behind the panel) and is completely sealed.

Makers: AB Metal Products, BERCO, Bulgin, Diamond "H" Switches, Electrothermal Engineering, Erie, N.S.F., Oliver Pell Control, Painton, Plessey, S.T.C., Taylor, T.M.C., Walter Instruments, Wright & Weaire.

CHASSIS FITTINGS

AN interesting new development in miniature valveholders, shown by Clix and McMurdo, was the use of nylon-loaded Bakelite for body mouldings. This is an improvement on the normal fibrous loading material, as nylon is characterized by its low moisture absorption and so goes a long way towards keeping the resistivity up and the losses down. Moreover, the development bridges a gap in quality which has long existed between ordinary Bakelite and the more expensive PTFE.

The versatility of spring steel for simple fastening methods was well demonstrated on the Simmonds Aerocessories stand.

Prefabricated cabinets were again displayed by Widney-Dorlec, and the range of parts has now been extended to include sloping fronts and to make the system adaptable to standard rack construction.

Makers: Antiference, Associated Electronic Engineers Ltd., Belling & Lee, BERCO, British Mechanical Productions, Bulgin, Carr Fastener, H. Clarke & Co., Colvern, Electrothermal Engineering, Guest Keen & Nettlefold, Hellermann, Igranic, Imhof, Long & Hambly, McMurdo, Painton, Plessey, Reliance, Erwin Scharf, Simmonds Aerocessories, Taylor, T. C. & M., Thermo-Plastic, T.M.C., Tucker Eyelet, Walter Instruments, Walter J. & H., Widney-Dorlec, Wingrove & Rogers.

AERIALS

MAKERS of aerial equipment have been overhauling their products with the view to eliminating redundant models and telescoping types where possible. As a result Belling and Lee have introduced a single new co-axial cable plug to take cables of from $\frac{1}{4}$in to $\frac{5}{16}$in diameter, so covering both 50-ohm and 75-ohm sizes, also local and fringe-area types.

A novelty in aerials, at least so far as this country is concerned, was the latest Antiference combined television-f.m. aerial. Advantage is taken of the difference in polarization of the two transmissions to mount two half-wave dipoles at right angles on a common centre unit of their "Antex" weatherproof type. The vertical dipole is for television and the horizontal for f.m. They are quite separate electrically and each has its own feeder.

Makers: AB Metal Products, Aerialite, Antiference, B.I. Callenders, Belling & Lee, Telegraph Construction & Maintenance.

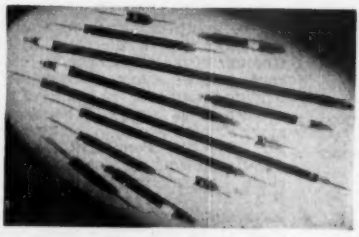
VIBRATORS

EXAMPLES of both synchronous (self-rectifying) and non-synchronous (interruptor) vibrators were on view and the power ratings of these were noticeably high. The heavy-duty 220-V model shown by J. & H. Walter, for instance, will handle anything up to 440 watts.

Makers: Plessey, J. & H. Walter, Wright & Weaire.

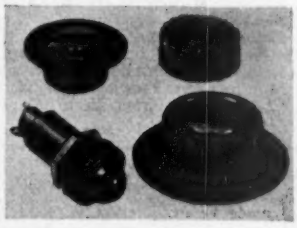
SOUND REPRODUCTION

GRAMOPHONE pickups have been through a period of consolidation in design, and detail improvements are apparent. For example, the lightweight movements in the Goldring (Erwin Scharf) range are now supplied with a new damping material of zero temperature coefficient which is also resistant to atmospheric changes. Production models of "turnover" pickup heads

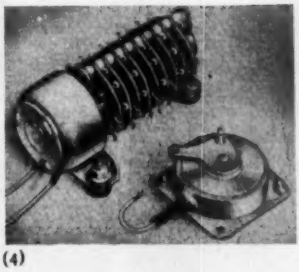


(1)

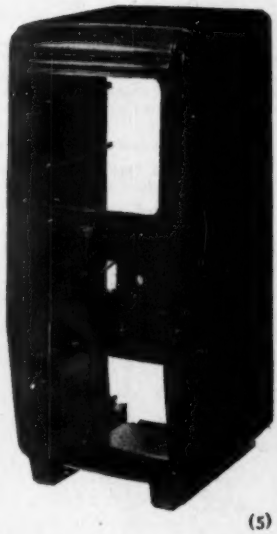
(2)



(3)



(4)



(5)

(1) Representative group of selenium tubular rectifiers by S.T.C. (2) Elac ion trap magnet. (3) Three new control knobs and a signal lamp, made by Bulgin. (4) Rotary solenoid relay by British N.S.F. (left) as a circuit selector and (right) for actuating a high-torque arm. (5) British Moulded Plastics console television cabinet, standing 36 in high, made for Sobell Industries.

with stylus radii on one side for 78-r.p.m. and on the other for micro-groove records were shown with magnetic movements by Garrard and piezoelectric crystal by Cosmocord. Interchangeable heads are favoured by Decca.

The loudspeaker situation, too, is one of stabilization, with a tendency for firms to specialize in one particular sphere, e.g., domestic high-quality, public address, receiver manufacturers' types, etc. Very few additions to existing ranges were noted, but Goodmans have introduced an oval-diaphragm type for car radio and similar applications where small dimensions are essential. It is claimed that this new Model T22/470 has the bass response of a much larger unit and that the high frequencies are distributed over a wide angle.

A new form of spindle attachment in the British Ferrograph (Wright and Weaire) tape recorder gives positive retention for the spools with quick release, and the recorder can now be operated with safety in a vertical position. A third tape speed has been added of only 1⅞in/sec giving a playing time of four hours on a 1,200ft reel of tape.

Makers*: Acoustic Products (LS, D); Birmingham Sound Reproducers (GM, GU, RC); British Rola (LS); Celestion (LS); Cosmocord (E, M, PU); Decca (DR, GU); Edison Swan Electric (E, LS, PU); Electro Acoustic Industries (LS); Garrard (GM, GU, RC); Goodmans Industries (LS); Plessey (GM, GU, RC, LS, PU); Reslosound (LS, M); Erwin Scharf (PU); Truvox Engineering (LS); Vitavox (LS, M); Wright & Weaire (MR).

**Abbreviations:* D, diaphragms; DR, disc recorders; E, earphones, headphones; GM, gramophone motors; GU, gramophone units; RC, record changers; LS, loudspeakers; M, microphones; MR, magnetic recorders; PU, pick ups.

MATERIALS

NEW techniques in coil winding are opened up by the introduction of thermoplastic-covered instrument wires by B.I. Callenders Cables and the London Electric Wire Company, under the trade names of "Bicaloc" and "Lewmexbond" respectively. Normal enamel-covered wires are given a thin outer coating of thermoplastic material and are wound in the usual way. Heat treatment and subsequent cooling effectively bonds adjacent turns and the coil is then self-supporting without the need for formers or even taping. One obvious application is for the deflector coils of cathode-ray tubes, and there are many problems in radio and light electrical engineering for which this method provides an elegant solution.

Permanent magnet performance can be improved by as much as 25 to 50 per cent if the metallurgical structure of the magnet can be influenced to grow columnar crystals extending throughout the length of the magnet. This fact was demonstrated at the Physical Society Exhibition last year by the Permanent Magnet Association and the decision to include these magnets in the R.E.C.M.F. show is based on the encouraging progress which has been made in the past twelve months towards normal commercial production. Consistent improvement in the performance of Alcomax III and IV has resulted in the quotation of revised figures in the latest data sheets.

The range of cored solder types seem, if possible, wider than ever and Multicore were showing six standard tin-lead alloys, from 20 to 60 per cent tin, in nine gauges from 10 to 22 s.w.g. and in two flux percentages. Enthoven are supplying coloured rosin cores (in red, blue, green and yellow) with the object of facilitating inspection for unsoldered joints in complex circuits.

Among rubber products, or perhaps more precisely elastomers, two items were noted. Long and Hambley have developed a new finish for their television tube masks involving a latex - based lacquer. Hellermann Electric are making a wide range of grommets, sleeves and mouldings in an elastic form of p.v.c. known as "Helvin." One application is for cathode ray tube covers to reduce factory handling risks from implosion.

Makers*: Associated Technical Manufacturers (C, CO, IS, PVC, W); Birmingham Sound Reproducers (MT); Bray (CE); B.I. Callenders Cables (C, IS, W); Bullers (CE); H. Clarke (Manchester) (CF, IM, IS); De La Rue (IM, IS, W); Du Bois (S); Duratube & Wire (C, IS, PVC, W); Edison Swan Electric (C); H. J. Enthoven (S); Fine Wires Ltd. (CO, W); G.E.C. (MT); Hellermann Electric (IS); London Electric Wire Co. (IS, W); Long & Hambly (RP); Magnetic & Electrical Alloys (M, L); Mullard Electric Products (M, DC); Multicore (S); Murex (M); Mycalex (IM); Permanent Magnet Assoc. (M); Plessey (CE, DC); Reliance Electrical Wire (B, C, CO, IS, PVC, RP, W); Salford Electrical Instruments (DC); G. L. Scott (L); Suflex (B, C, CO, IS, PVC, W); H. G. Symons (IM, V); Taylor Tunnicliff (CE); Telegraph Construction & Maintenance (C, CO, IM, M, W); Telephone Manufacturing Co. (DC); Thermo-Plastics, Ltd. (B).

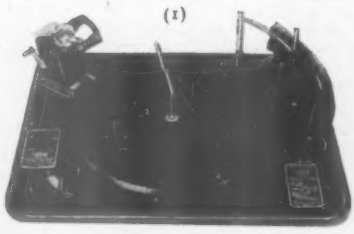
**Abbreviations:* B, braiding; C, cables; CE, ceramics; CF, coil formes, bobbins; CO, cords; DC, dust cores; IM, insulating materials; IS, insulating sleeving; L, laminations; M, magnets and magnetic alloys; MT, magnetic recording tape; PVC, polyvinyl chloride tapes, wires, etc.; RP, rubber products; S, solder; V, varnished materials; W, covered wires.

(1) Garrard type 80 record changer for 45, 33⅓ and 78 r.p.m records.

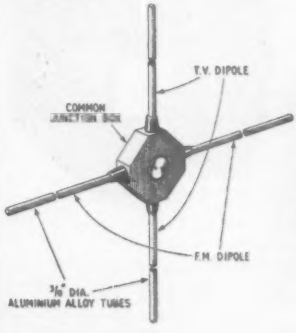
(2) Combined television/f.m. aerial made by Antiference. Separate feeders are employed.

(3) Goodmans oval-diaphragm loudspeaker, Type T22/470.

(4) Decca transcription-type two-speed gramophone turntable.

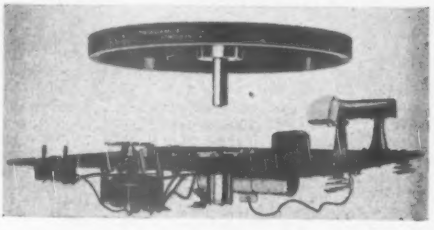


(1)



(2)

(3)

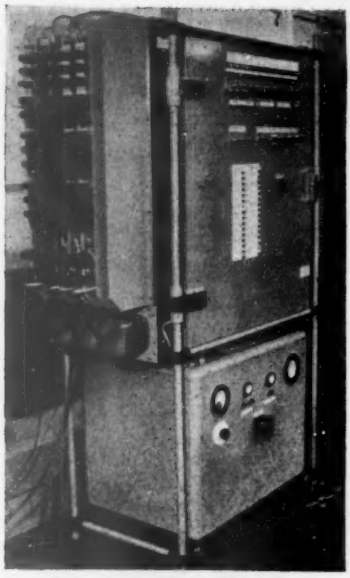


(4)

Physical Society's Exhibition

Apparatus for Research and Development

The sixth post-war exhibition of the Physical Society was held in London from 6th-11th April. This review deals with exhibits of radio and electronic interest.



N.P.L. digital computor.

RESEARCH

SEVERAL firms exhibited different forms of automatic equipment for plotting aerial-radiation diagrams. An important use of the Ferranti system is in designing aircraft aerials. A scale model of the aircraft is used and the aerial is energized to radiate a proportionately reduced wavelength. The model is rotated slowly and the table of the recorder rotates in synchronism while the recording pen moves under the control of the receiver output. In the Belling-Lee apparatus the diagram is displayed in Cartesian co-ordinates on a c.r. tube, the X deflection being obtained from a potentiometer attached to the rotating mast of the aerials under test. Similarly, in the Ekco centimetre-wave apparatus it is the receiving aerial which rotates.

G.E.C. Research Laboratories showed a voltage-controlled swept-frequency oscillator covering 30-140Mc/s. It is intended, in conjunction with a c.r. display, for the visual alignment of amplifiers. It is a phase-shift oscillator with four cathode-follower stages and one amplifier giving a gain slightly above the attenuation of the phase shifter.

An electronic digital computer was shown by the N.P.L.; intended primarily for testing chassis of the ACE it can perform simple sums like addition, multiplication and division.

The Elliott swept-frequency impedance meter operates at 9,400Mc/s. The amplitude and phase reflected by the component under test are measured in a waveguide having two directional couplers. The reflection coefficient is displayed on a c.r. tube over which a Smith chart is placed.

T.R.E. showed a system of matching a dielectric to free space which is analogous to "blooming" in optical work. The surface of the dielectric is provided with narrow slots having a depth of a quarter wavelength. R.R.D.E. exhibited a four-channel electronic switch for use with non-recurrent waveforms; it can be used with any oscilloscope.

The Metropolitan-Vickers high-speed recurrent-waveform monitor can display waveforms with frequencies up to 300Mc/s and gives a stable display even when the wave jitters with respect to its driving pulse. A sampling technique is used, the gating width being only 0.001μsec. About 100 samples are needed to produce the displayed wave in dotted form.

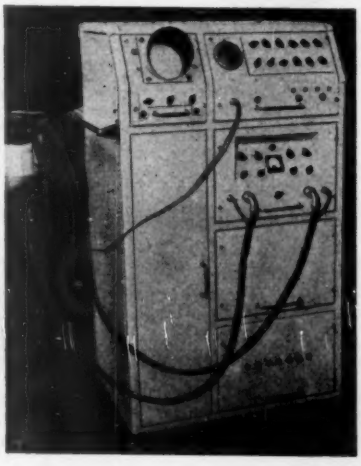
INDUSTRIAL ELECTRONICS

MANY physical effects are utilized in the control of industrial processes, but few systems are without some form of electronic link in the chain between cause and effect, and each year sees new extensions to the already wide field of electronics in industry.

Ball-type grindings mills, for example, which are dependent on critical levels of material for efficient operation, are normally controlled by skilled operators who judge the rate of feed required by the character of the sound emitted by the mill. The judgment of the operator may be affected by health, and to provide a more objective control Standard Telephones and Cables have developed an acoustic mill feed controller (Type 74701-A). The sound picked up by a microphone is amplified and passed through filter circuits which select the predetermined critical frequency bands. The output is applied to a marginal relay which operates normally in the floating condition; top and bottom contacts operate when the noise level is higher or lower than the optimum, and control the field current of the mill feed motor. A large indicating meter may be used where more critical manual control is required.

The servo-controlled self-balancing capacitance bridge developed by Fielden is used in a new type of recording pressure gauge named the "Manograph." The mechanism is similar to that of the "Servograph" but the recorder pen, instead of following the movements of a meter pointer, is controlled by a ring electrode which encircles one limb of a manometer "U" tube containing any suitable conducting liquid.

Metropolitan-Vickers high-speed waveform recorder.



Many methods ranging from β-ray absorption to simple pocket magnetometers have been devised for measuring thickness of materials.

Sheets of material of constant density can be checked for thickness (and vice versa) by passing them between a radioactive source (usually thallium 204) and an ionization chamber, the output of which is amplified and applied to a meter calibrated directly in density-thickness (usually mg/cm²). Equipment for permanent installation in mills was shown by Baldwin, Ekco and Electronic Instruments. A self-contained battery-operated portable model was shown by Baldwin.

The technique of flaw detection by ultrasonic methods involves considerable skill in the interpretation of results and also the expenditure of much time if records are to be made for assessment of the relative importance of different flaws. Normally flaws are shown by vertical peaks in a horizontal time-base scale on a c.r. tube, and a fresh record must be taken for each position of the exploring probes. Glass Developments, Ltd., were showing a new continuous scanning method in which the condition of the whole specimen is presented in a single display. Distance from the surface is indicated, as before, in the horizontal axis, but the position of the flaw is shown by intensity modulation of the electron beam. Vertical deflection is controlled by the movement of the probe along the specimen and a two-dimensional picture on the lines of a television raster is obtained.

ELECTRONICS, NON-INDUSTRIAL

THE impact of atomic research on the electronics industry was made very evident by the large showing of instruments for detecting and measuring radiation, and amongst the annual parade of monitors, counters, scalers, ratemeters and the like were one or two items of more than usual interest. The scintillation counter shown by Ekco, for instance, causes the radioactive specimen to activate some kind of phosphor material—the scintillations from this being converted into pulses by a photo-multiplier tube and then registered electronically in the usual way. A multiple Geiger-Muller counting apparatus was demonstrated by Nucleonic and Radiological Developments. Ten G-M tubes with samples were automatically selected in time sequence and the resulting counts were registered by a pen recorder, the idea being not only to save time but to avoid the contamination which occurs when the same G-M tube is used for different samples in turn.

Smallest of all the detecting in-

(1) Oscillator with jointed quartz crystal working at 100 c/s, made by Salford. (2) Acoustic mill feed controller (S.T.C.). (3) Portable beta-ray thickness gauge (Baldwin Instruments). (4) Ultrasonic scanner for flaw detection (Glass Developments Ltd.). (5) Mullard electronic polarograph. (6) Portable radioactive ore detector by Ekco, with cover removed.

struments was the new type of "fountain-pen" pocket dosimeter containing an ionization chamber and electroscope; examples were shown by Baldwin, Cintel and the Commissariat à l'Energie Atomique. Other new medical instruments were an arterial blood-pressure recorder by Southern Instruments (with a variable-capacitance pickup device controlling a frequency-modulated amplifier), and a portable electroencephalographic equipment by Ediswan—both of them working into pen recorders.

Measurement of inorganic fluctuations was also represented—by the Pye geophone, a low-frequency vibration pickup for registering earth movements. In the field, the outputs of several geophones are fed into a 12-channel "suitcase" amplifier, and one of the miniature amplifier channels from this was also on view. Passing from *terra firma* to *aeris mobilis*, the Meteorological Office showed an interesting photoelectric hygrometer for automatically measuring the frost-point of the air. Light scattered from a deposit of natural frost on a cooled metal "thimble" is collected by photoelectric cells, and these control a heater coil in the thimble so that the frost deposit is kept constant; another resistance coil then measures the temperature.

One of the most consistently useful of electronic aids is the d.c. amplifier, and at the exhibition four different types were represented. The first was the straightforward direct-coupled amplifier with, in some cases, automatic drift correction; the second contained a "chopper" mechanism for converting the d.c. into a.c.; the third caused the d.c. variations to amplitude-modulate a carrier frequency; while the fourth used a mirror galvanometer to produce an unbalance current between two photocells.

VALVES AND C.R. TUBES

OUTSTANDING among the various special-purpose valves on show were two new stabilizers—one for current and the other for voltage. The constant-current barretter shown by Siemens had a tungsten filament in hydrogen (giving about ten times the life of an iron-wire filament), and a system for preventing the filament from losing heat—thereby increasing its resistance with voltage and obtaining a flatter characteristic. The bulb is divided into two sections (one containing the filament) by a mica disc, so that although the pressures in the two halves can equalize there is very little transfer of heat from the filament.

Corona discharge in pure gas was the principle of the new voltage stabilizer demonstrated by Nucleonic and Radiological Developments. The stabilizing voltage was virtually the same as the striking voltage (420V), the initial current was quite small (about 10μA), and an increase of the supply voltage to 800 produced only a 7-V rise in the stabilized voltage. Types with stabilizing voltages up to 1,000V are also available.

Other items of interest were a coaxial-type silicon crystal for use up to 10,000Mc/s, shown by G.E.C., a 100-c/s quartz crystal oscillator by Salford, and a double-beam c.r. tube (20th Century Electronics) having common time-base plates but entirely separate guns and deflection plates.

COMPONENTS

AS might be expected, the components exhibited were mainly of the precision type. Precision moulded silvered-mica capacitors having an insulation resistance greater than 200,000MΩ over a temperature range of −40° C to 100° C were shown by Johnson, Matthey. A variable capacitor of 320pF swing was shown by Mullard. It has PTFE insulation, bi-metallic temperature compensation and brass vanes in a stress-relieved strain-free housing. It has an s.l.f. law to within 0.1%.

British Electrical Resistance have a hermetically sealed potentiometer of 5W rating in which Perbunam washers provide the seal. They also have a range of oval vitreous resistors.

Sine/cosine potentiometers, unsealed, are produced by Kelvin Hughes; a wide range of resistance values is available, while Unit resistance boxes are made by George & Becker.

Plessey showed extremely compact tantalum electrolytic capacitors for operation over the range −60° C to 200° C. A capacitance of 55μF at 80V working is typical.

TEST AND MEASURING GEAR

At the Physical Society's and R.E.C.M.F. Exhibitions

Though test and measuring equipment predominated at the exhibition of the Physical Society, a certain amount appeared also at that of The Radio and Electronic Manufacturers' Federation. Apparatus is dealt with in this review irrespective of the exhibition at which it appeared.

SIGNAL SOURCES

IT is interesting to observe that in this electronic age one of the earliest methods of generating a constant frequency still performs a useful function. The particular device in mind is the electrically maintained tuning fork, a 50-c/s version of which has recently been introduced by Dawe Instruments for use where no other suitable reference of frequency can conveniently be used. It is operated by a 4-volt battery and utilizes a carbon button microphone. Its accuracy is 0.1 per cent, stability 0.01 per cent and it gives 18 V r.m.s. output.

Signal generators of one kind or another are now beginning to make their appearance at the other end of the frequency spectrum and Metropolitan Vickers now have a klystron oscillator unit covering 8,500 Mc/s to 9,500 Mc/s.

A signal generator for use on the "X" band is made also by Elliott Bros.; again a klystron is employed, but in this case the signal is frequency-modulated about a mean value of 9,400 Mc/s.

To the range of precision equipment made by Standard Telephones has been added a waveform generator designed for testing television relay systems. It provides synchronizing pulses to B.B.C. standards and also a signal in the form of a pulse, the width of which is variable from 2 to 83 μsec. The amplitude of the sync and of the pulse signal can be varied independently and picture signals from an external source can be injected and mixed with sync and black-out pulses.

A much simpler form of television test set is included among the latest Avo instruments. It is basically two instruments, a signal strength meter for direct measurement of signals picked up by the aerial, and a square-wave generator for modulating an existing signal generator covering the television frequencies. Two frequencies are provided, giving the familiar vertical and horizontal bars.

Among the more specialized forms of signal sources is an r.f. generator giving the choice of a number of spot frequencies from an oscillator having a single crystal only. It is a Marconi development and utilizes their "FMQ" technique and is intended as a source of drive for a multi-channel v.h.f. transmitter. In one form 25 spot frequencies of 12-kc/s bandwidth at a carrier frequency of 225 Mc/s are available.

OSCILLOSCOPES

THE Nagard 103 instrument is called an oscillometer because of the special provision which is made for measuring voltage. Also, it has a time base which is calibrated in frequency to within 2 per cent and in time to 5 per cent. It is arranged in two fitting cases, one of which is the power supply and the other the housing for the c.r. tube and the controls; it also accommo-

dates the time bases and amplifiers as sub-units of which several alternatives are available. A 6-in tube is used with an edge-illuminated graticule which is ruled on both sides to prevent parallax.

The Marconi Instruments Q scan is a portable instrument which has the usual oscilloscope facilities but is designed primarily for the visual alignment of television receivers. There are both X and Y amplifiers, but the latter can be switched to act as a time base which is used to frequency-modulate an r.f. oscillator. This has a mean frequency which can be adjusted over the normal range of television signal and intermediate frequencies.

The Elliott oscilloscope is of the ultra-high-speed type with sweeps ranging from 0.05μsec to 2.5msec. With the tube operating at 10kV writing speeds up to 20,000km/s can be obtained.

Of the more general-purpose types the Cossor 1049 double-beam oscilloscope now has a 4-in flat-faced tube operating at 2kV. The time base gives sweeps of 150μsec to 1.5sec and can be used repetitive, triggered or single stroke. The Mullard wide-band oscilloscope can be used with a triggered sweep and can resolve pulses of 2mμsec duration.

MISCELLANEOUS TEST EQUIPMENT

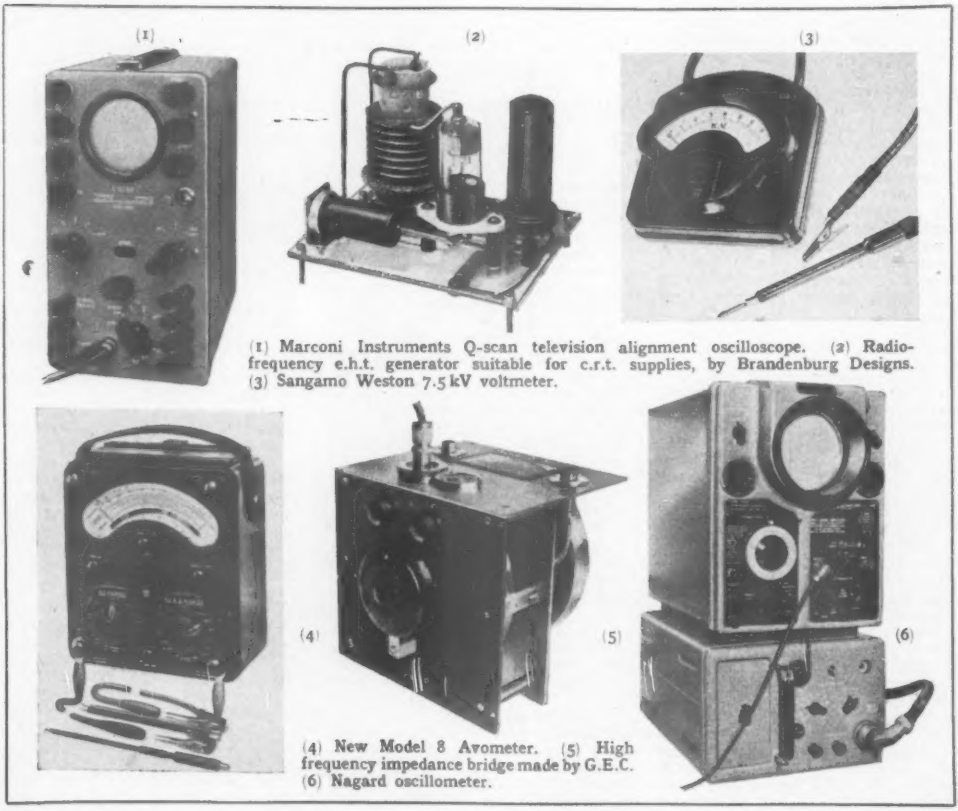
A SMALL but useful piece of test gear included in the current range of sets made by Marconi Instruments is a wide-range absorption wavemeter. With eight plug-in coils it covers 100 kc/s to 100 Mc/s. The dial is directly calibrated in frequency. It embodies a 0-50 μA meter and a germanium crystal.

There are quite a number of new single and multi-range test meters available this year. Avo have a new Model 8 Avometer providing some 50 ranges and a sensitivity of 20 kΩ/V on d.c. and 1 kΩ/V on a.c. A useful feature is the inclusion of a press switch which reverses the connection to the movement to facilitate measurements without changing over the test leads, where changes of polarity may be involved.

Taylor Electrical have a new universal meter, the Model 88A, for a.c. and d.c. volts up to 5 kV, current up to 10 A and with facilities for capacitance, inductance and resistance measurements. It also has a buzzer for continuity testing. The sensitivity is 20 kΩ/V on d.c. and 2 kΩ/V on a.c.

There is a 0-7.5 kV voltmeter among the Sangamo Weston range of meters; also a new electronic r.m.s. voltmeter reading up to 750 V, the lowest scale being 0-1.5 V. The input resistance is 1 MΩ and it has first-grade accuracy up to 10 kc/s. A large 6-in scale is employed. The final indicator is a thermo-couple and a 10-mA moving-coil meter, so despite its high sensitivity it is by no means a delicate instrument.

A high-frequency bridge for impedance measurements over the range 20-100 Mc/s has been developed by the General Electric Company. It makes use of a continuously variable ratio arm taking the form of a semi-circular copper rod inductor of high stability with a sliding contact. It is intended primarily for measurements on aerials and feeder systems.



(1) Marconi Instruments Q-scan television alignment oscilloscope. (2) Radio-frequency e.h.t. generator suitable for c.r.t. supplies, by Brandenburg Designs. (3) Sangamo Weston 7.5 kV voltmeter.

(4) New Model 8 Avometer. (5) High frequency impedance bridge made by G.E.C. (6) Nagard oscillometer.

Frequency Modulation

1—Simple Introduction

By "CATHODE RAY"

ALTHOUGH I wrote under the same title not so very long ago (September 1948) some readers may have been too young then, or did not consider f.m. had become a "live issue," or perhaps were frightened or baffled by my vector diagrams. And those who did read it have probably forgotten all about it by now and would be glad of a recap., seeing that f.m. broadcasting is so much in the limelight these days. This first article is intended to be a really simple outline. Anybody who wants to pursue the subject further can do so next month (and probably the month after that).

If you had a radio transmitter and amused yourself by turning the h.t. voltage rapidly up and down, as in Fig. 1 (a), you would vary the amplitude of the radiated waves in time with your movements. The resulting r.f. waveform would be something like Fig. 1 (b). You would be causing amplitude modulation, though the modulation frequency would admittedly be rather lower than usual. If for a change you tried the same trick on the oscillator tuning knob, twiddling it to and fro in the Fig. 1 (a) manner, you would cause frequency modulation, and the r.f. waveform would look like Fig. 1 (c). Instead of the amplitude varying and carrier-wave frequency remaining constant it would be the other way about. In practice, of course, the variations (of amplitude or frequency) are caused by the audio-frequency or other signal voltages. With a little speeding up of the time scale, Fig. 1 (a) can be taken as representing these. At the receiving end the carrier-wave variations are translated back into a copy of the original a.f. The only essential difference in the f.m. receiver is that it must respond to frequency variations, preferably with as little distortion as possible. Any ordinary a.m. receiver can receive f.m. after a fashion if it is tuned so that the carrier frequency comes on the slope of the resonance curve instead of at its peak (Fig. 2). The increases and decreases in carrier frequency then cause increases and decreases in detector output voltage. To obtain the benefits that f.m. has to offer, however, other changes in design are necessary.

What are these benefits? They can be stated very briefly: better signal-to-noise ratio.

So far everything is perfectly clear and simple. It is when one asks how much benefit f.m. gives that complications begin. The variety of statements —all more or less true—that are used in answer to this question can only be compared with what one gets during a General Election. Some enthusiasts

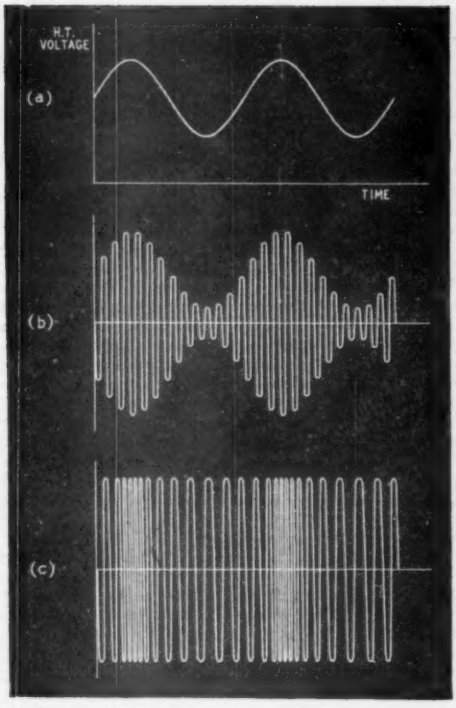
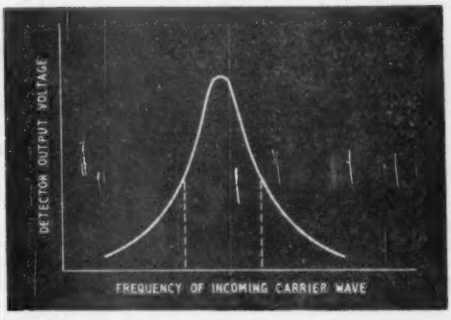


Fig. 1. Varying the h.t. voltage of a transmitter up and down as shown at (a) makes the r.f. amplitude vary in the same way (b), and is a simple example of amplitude modulation. Manipulating the frequency control in the same way produces frequency modulation (c).

Fig. 2. An ordinary a.m. receiver can be used to receive f.m. (though not very satisfactorily) by mistuning it so that the unmodulated carrier-wave frequency comes on the slope of the receiver's resonance curve, at either of the dotted positions. The variations in carrier frequency due to modulation then cause roughly corresponding variations in detector output voltage.



have claimed that f.m. is about 1,000 times better than a.m. ; on the other hand it has been said that f.m. is no better, if even as good. The reason for such apparent contradiction is that it all depends on how the comparisons are carried out. To make any sense of claims for or against f.m. it is necessary to have a reasonably clear picture of its theory.

Let us start with an unmodulated carrier wave. Its frequency (which of course is r.f.) can be denoted by f_c. Then there is the modulation frequency, which for the sake of example we shall assume to be a.f. (it might of course be v.f.), to be denoted by f_m. It now the carrier is amplitude-modulated, the well-known result is that side frequencies are formed, f_c+f_m and f_c-f_m. The total bandwidth is therefore $2f_m$. Since the carrier is usually modulated at frequencies all over the a.f. band, there are continuous groups of side frequencies called sidebands. The loudness of the programme is represented by the depth of modulation—the amount by which the amplitude of the carrier wave is varied compared with its unmodulated amplitude (Fig. 3). When the variation equals the unmodulated amplitude, so that the carrier fluctuates between twice its unmodulated amplitude and zero, the depth of modulation is 100% ; and since the amplitude cannot be made less than zero that is the limit.

The obvious way of adapting Fig. 3 to illustrate depth of frequency modulation would be to write "frequency" instead of "amplitude." Then 100% modulation would mean that the carrier wave frequency was varying from zero to double, which would be more than a trifle inconvenient. It would of course be quite absurd. On this scale of reckoning, the depth of frequency modulation is always very small. The term actually used is *frequency swing*, which is the amount modulation causes the carrier frequency f_c to vary above and below its normal. For example, a frequency swing of ± 10 kc/s would cause a 100-Mc/s carrier wave to wobble between 99.99 and 100.01 Mc/s. The greater the frequency swing the louder the programme. The practical limit is not fixed by any natural boundary, as in a.m., but by the bandwidth that the transmitter is allowed to occupy, which is a matter of decision. This maximum allowable frequency swing, is, according to a British Standards definition, *frequency deviation*. But the term is often used to mean frequency swing. Personally I think this is a pity, because the distinction is a useful one, and I am going to stick to the standard terms, abbreviating them by f_s and f_d respectively.

The Inventor's Dream

How is the deviation, or maximum allowable swing, decided ? Reducing it reduces the a.f. voltage output obtainable from the detector, but that can be made up (within reason) by a.f. amplification. Nowadays, when every kilocycle of bandwidth is precious, it would seem an excellent idea to make it as little as possible. Every now and again a would-be inventor hits on the perfectly marvellous scheme of making it much less than the highest modulation frequency, so abolishing at one stroke the difficulty with a.m. that the bandwidth occupied is twice f_m. If f_d were made, say, 1 kc/s, the frequency of the carrier-wave would be varied between limits only 2kc/s apart and yet we could receive audio frequencies up to 15kc/s if we liked, and at the same time pack two or three times as many stations into the medium waveband ! Unfortunately this is only a dream, as was proved as long ago as 1922 (though that didn't stop all the dreamers by any means). It is by no means easy to see why it doesn't work, so at this stage it must be just accepted as a fact that the bandwidth with f.m. is greater than either $2f_m$ or $2f_d$.

We shall see later how the choice of f_d affects the working of the system. It is generally considered in relation to f_m. In fact there is a special name for the ratio of f_d to the highest f_m—*deviation ratio*. This is sometimes confused with the ratio of f_s to any f_m being considered, which is called the *modulation index* and usually denoted by M.

Important Distinctions

To make the meanings of these terms clearer let us take an example—an f.m. broadcasting station in which audio frequencies are included up to 10kc/s. In some f.m. stations the deviation f_d is made less than the highest f_m, but in broadcasting (for reasons I shall explain later) it is generally several times greater. The number of times greater is the deviation ratio, so if in this case we decided to make f_d 50kc/s the deviation ratio would be 5. But the bandwidth occupied by the transmitter at any particular moment depends not on the highest f_m that *could* exist or on the greatest frequency variation or swing (f_s) that would be allowed, but on the actual f_m and f_s. The ratio of these two, f_s/f_m, is the modulation index. If a note of 2kc/s were being broadcast at half the maximum modulation depth (25kc/s), M would be $25/2 = 12\frac{1}{2}$. The thing to remember is that deviation ratio is part of the specification of an f.m. transmitter, like its power and its carrier frequency, but modulation index refers to what the transmitter is actually doing at the moment. Except when broadcasting a tuning note (or nothing at all) M is continually varying.

Since practically the whole point of using f.m. is to obtain quieter reception, another important matter to be clear about is the nature of the noises to be overcome. There are two main kinds. One is the continuous hissing or rushing sound that is always heard when a large amount of amplification is in use. It is due to random movements of electrons in circuits and valves, which can only be stopped altogether by reducing their temperature to -273°C, and nobody has ever quite managed that, even at enormous expense. The amount of this kind of noise can be calculated fairly exactly. It depends on the temperature, but the difference between winter and summer is too small to be important. It depends on the resistance of the circuit, or anode current and type of valve. And the noise power is distributed uniformly over all frequencies, so the noise one gets is proportional to the frequency bandwidth accepted by the receiver or amplifier. Since it can't be stopped, the usual method is to have so much signal power that one doesn't need to use enough amplification to hear the noise. It is shouted down. Random noise gives no trouble when listening to a 100-kW station within 20 or 30 miles on a good aerial. It is when listening to a weak or distant transmitter on a poor aerial (such as a portable) that it becomes a nuisance. This is where f.m. gives an advantage over a.m. Oddly enough (seeing that this noise is proportional to bandwidth) the advantage increases with the bandwidth of the system, and as spare bandwidth is now non-existent on the medium frequencies it is necessary for f.m. stations to

work at very high frequencies. Released from the pressure of the medium waves, where top and perhaps even middle audio frequencies have to be drastically cut to avoid interference, the quality of reproduction can be much improved. F.m. enthusiasts in the past have sometimes claimed credit for this, but of course it is really due to v.h.f. and is obtainable equally with a.m.

The other kind of noise includes everything else—chiefly atmospherics and "man-made" electrical noises. These are more or less unpredictable, depending on circumstances and conditions. But nearly all of them become less and less troublesome as the reception frequency is raised, so that at the 100Mc/s or thereabouts used for f.m. almost the only kind to worry about is motor-car ignition noise. And that really is a worry. It takes the form of sharp pulses at each spark in the engine, so is commonly referred to as impulsive noise. Random noise is a continuous background, generally well below the programme level (or it wouldn't be worth listening to); impulsive noise is not continuous, but when heard its pulses have peaks generally far greater in amplitude than the programme signal level. So a valuable improvement can be gained by cutting the peaks down to the signal level.

It is more obvious how this can be done with f.m. than with a.m., because the signal amplitude with f.m. is constant (Fig. 1(c)), and it doesn't matter even if the signal peaks are trimmed off. So it is perfectly simple to use a limiter in front of the detector to do so and thereby remove the worst of the noise pulses. But one must not imagine, as so many have done, that because of this an f.m. receiver cuts out impulsive noise completely. As we shall see later, the pulses frequency-modulate the signal and get in that way. Nevertheless f.m. does help a lot. But here again many persons have allowed their f.m. enthusiasm to run away with their judgment. Although it is not so obvious how pulse limiting can be applied to a.m. (Fig. 1(b)) so as to be effective, and yet to avoid the severe distortion that would result from clipping the signal peaks, it can be done. But because even a high-fidelity a.m. receiver can be tuned fairly sharply on the v.h.f. waves, people made the mistake of comparing a $\pm$ 15kc/s band a.m. receiver with a $\pm$ 100kc/s f.m. receiver. Whereas a wideband set preserves the sharp brevity of the noise pulse, so that most of its power is above audible frequency, and it is soon over, the more highly selective a.m. tuner draws it out into a much broader shape, so that it passes through into the a.m. part of the receiver. When a fair comparison is made, using an equally wide band in both sets and the best available noise-limiting technique, there is remarkably little difference between f.m. and a.m. An important point with f.m. is that freedom from impulsive noise depends much more on accurate receiver tuning than with a.m.

Transmitter Power

The question of freedom from noise is bound up with the transmitter power. As we have noted, noise can always be thrust farther into the background by using more power. That generally means a larger transmitter. But one of the advantages of f.m., contributing to better signal/noise ratio, is that considerably more power can be radiated without enlarging the transmitter. The limiting factor is the highest peak that has to be handled, and with a.m., as you can see from Fig. 3, this is twice the unmodulated or average amplitude. If it were changed over to f.m., the peak amplitude could be maintained all the time (compare Fig. 1(c)), so its average current or voltage would be doubled. The power is equal to current $\times$ voltage, so would be four times as great. Other things being equal, then, an f.m. transmitter delivers a stronger signal than a.m. Alternatively, to deliver the same strength of signal with a.m. necessitates a larger and more expensive transmitter. In broadcasting, however, the cost of the transmitter is much less important than the cost of the receiver. Taking the system as a whole, it is no economy to save £20,000 on the transmitter if it is thereby necessary to spend an average of 5*s*. more on each of 100,000 receivers served by it; the result is a net loss of £5,000. It remains to be seen how the relative cost of a.m. and f.m. receivers works out. One would expect f.m. to be more, but of course it is difficult to make an exact comparison because the performance cannot be exactly the same in every respect, so the verdict depends a good deal on who makes it.

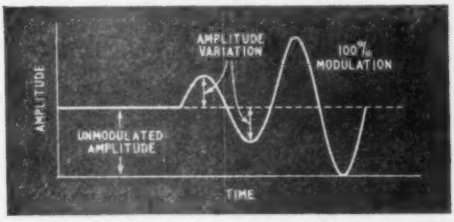
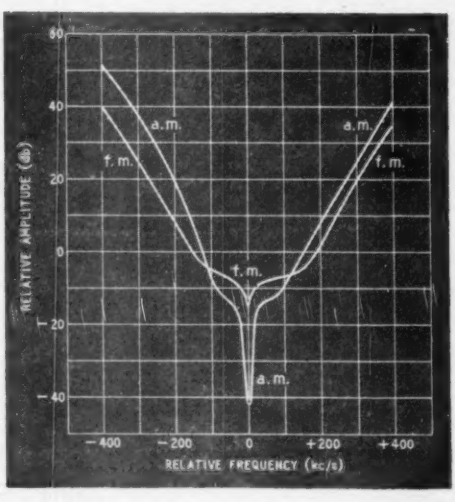


Fig. 3. Explanation of modulation depth in a.m.

Fig. 4. Showing how the strength of a signal required to cause just-audible interference varies with the frequency relative to that of a signal tuned-in. A.m. interference with an a.m. receiver is worse than f.m. interference with an f.m. receiver when the frequency difference is audible, but over 100 kc/s the position is reversed.



How about interference between stations—that great curse of medium-frequency broadcasting? Moving to the v.h.f. band leaves behind the great hurly burly, but if everybody does that won't the v.h.f. band in turn become the congested one, like some of the by-pass roads we have known? Well, in the first place there is considerably more room. The apparently narrow band between 3.00 and 3.05 metres alone, for example, is wider in frequency than the whole medium-wave band and long-wave band together. Not only so, but whereas the ionosphere reflections from a powerful medium-wave transmitter can cause interference far beyond its service area, v.h.f. waves are not reflected, so the same frequency can be used by another station only one or two hundred miles away. The use of f.m. helps here, because one of its peculiarities (called the "capture effect") is that if two stations are being received on the same frequency one of them has only to be two or three times stronger than the other to make it quite inaudible. In areas where both come in at nearly equal strength, neither can be heard properly.

Owing to the much greater width of the v.h.f. band, and the ability to use the same frequency channels over and over again at different places, each transmitter is allowed about 200kc/s instead of the miserable 9kc/s in the medium and long bands. If this sounds as if there is not much need for selectivity, you must remember that what counts is the ratio to the carrier wave frequency. A band of 200kc/s centred on 100Mc/s is only 0.2% of the carrier frequency, compared with 0.9% for 9kc/s on 1Mc/s. That being so, one has to consider the possibility of interference from a transmitter on another frequency—especially "adjacent-channel" interference. In this respect the advantage seems to be with a.m. Fig. 4* shows the results of a comparison between the two methods of modulation, when care had been taken to keep everything else the same. The "a.m." curve shows that when an interfering signal is within a few kc/s of the wanted one it can just be heard even when it is far weaker (about 40 db). An f.m. station has to be about 25 db stronger to produce the same interference. At about 100 kc/s off-tune there is no difference. But at 200 or more kc/s, a.m. interferes less, by about 10 db.

Next month I propose to go into the curious affair of f.m. sidebands, and why and how f.m. receivers can give quieter reception.

*M. G. Nicholson, *Wireless Engineer*, July 1947, p. 198.

MAGNETIC DICTATION MACHINE

AN interesting dictation machine, making use of rectangular sheets of coated magnetic recording paper, has recently become available in this country. It is known as the "Dictorel," and is made by the Belgian firm of A.C.E.C., whose London office is at 56, Victoria Street, S.W.1.

The leading edge of the recording paper is reinforced and provided at each end with a metal tag which engages with recessed hooks on the recording drum. These ensure accurate location of the paper, which is longer than the circumference of the drum and overlaps the leading edge. The recording head, which is driven parallel to the axis of the drum by a lead screw, makes a helical magnetic track 1mm wide with a pitch of 1.27mm; the recording speed is 8cm/sec.

"Dictorel" Type 402 magnetic recorder.

The paper is held continuously against the drum by three fixed external spring strips, which are felted and provide sufficient friction to keep the paper in register against the retaining hooks. No click can be heard as the trailing edge of the paper passes the sound head, and it was demonstrated that if the sheet is removed and replaced exact re-registration of the tracks at the overlap is automatically achieved.

Each sheet gives 12 minutes recording time, and the machine is fitted with a built-in loudspeaker and the usual remote control facilities for starting and stopping. A back-stepping control moves the sound head back one turn of the spiral trace, equivalent to 4 seconds, for each movement of the foot pedal or press button. For long repeats the head can be moved back quickly by hand.

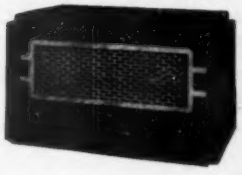
Four valves are used in the equipment and the frequency of the erase and bias current is 30 kc/s. About 1 watt output is available for the loudspeaker, and the quality of reproduction on speech is very good. Power consumption is approximately 45 VA at 110, 130 or 220 V, 50-60 c/s. The dimensions are about 15½in × 13½in × 6in high, and the price is £85, with accessories for dictation, or £82 with equipment for transcription. Spare recording sheets cost £2 3s for 10, or £3 18s for 20.

BOOK RECEIVED

Applied Electricity. By Edward Hughes, D.Sc.(Eng.), Ph.D., M.I.E.E. Student's book covering the syllabus of the Ordinary National Certificate in Electrical Engineering and other examinations of a similar standard. Pp. 394 + xxviii; Figs. 269. Longmans, Green & Co., Ltd., 6 & 7, Clifford Street, London, W.1. Price 10s 6d.

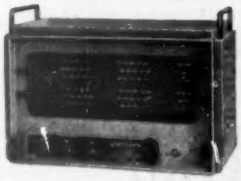
HIGH QUALITY REPRODUCTION

"FIFTY and THIRTY WATT" CINEMA AMPLIFIERS
as illustrated for single or double P.E.C. input with separate adjustable bias. Full range of tone controls to suit all needs with built-in Exciter Supply if required.
PRICES range from **34½ gns.** to **42½ gns.**



TYPE C.P. 20A AMPLIFIER
For AC Mains and 12 volt working giving 15 watts output, has switch change-over from AC to DC and "Stand-by" positions. Consumes only 5½ amperes from 12 volt battery. Fitted with mu-metal shielded microphone transformer for 15 ohm microphone, provision for crystal or moving iron pick-up with tone control for bass and top. Outputs for 7.5 and 15 ohms. Complete in steel case with valves.
PRICE **£28 . 0 . 0.**

FOUR-WAY ELECTRONIC MIXER
This unit has 4 built-in balanced and screened microphone transformers, normally of 50-30 ohms impedance. It has 5 valves and selenium rectifier supplied by its own built-in screened power pack consumption 20 watts. Suitable for recording and dubbing, or large P.A. Installations since it will drive up to six of our 50 watts amplifiers whose base dimensions it matches. The standard model has an output impedance of 20,000 ohms or less and any impedance can be supplied to order. PRICE **£24 . 0 . 0.**



OTHER MODELS IN OUR RANGE OF AMPLIFIERS
"SUPER-FIFTY WATT" - - - - - PRICE **36½ gns.**
"THIRTY WATT" - - - - - - - „ **30½ gns.**
"10-15 WATT RECORD REPRODUCER" „ **25½ gns.**
These are fitted in well ventilated steel cases with recessed controls, as illustrated.

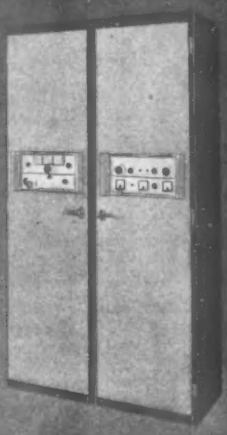
Full details upon request.
EXPORT ENQUIRIES INVITED.

VORTEXION LIMITED, 257-261 THE BROADWAY, WIMBLEDON, LONDON, S.W.19
Telephones: LIB 2814 and 6242-3 Telegrams: "Vortexion, Wimble, London."

HR 91 RECEIVER

A pre-tuned or continuously variable double super-heterodyne International Class Telegraph Receiver, range 3-27.5 Mc/s.

- Immediate selection of one of three channels.
- Double Diversity reception with electronic path selection.
- Provision for High Speed C.W. On/Off or F.S.K. reception.
- Self-contained for 200-250V. 50-60 c/s A.C. Supply.
- Automatic frequency control.



MARCONI COMMUNICATION SYSTEMS

SURVEYED · PLANNED · INSTALLED · MAINTAINED

MARCONI'S WIRELESS TELEGRAPH COMPANY LTD., MARCONI HOUSE · CHELMSFORD ESSEX

Sound Sales

PRODUCTS

CHOSEN BY THE COMMITTEE FOR EXHIBITION AT THE

—Festival—

A FESTIVAL OF MUSIC AWAITS YOU

VIA THE NEW

Tone Colour Unit

At our London Office and Showrooms:

LLOYDS BANK CHAMBERS, 125, OXFORD ST.

GERRARD 8782

The 1,000-Line Will o' the Wisp

Lines : Bandwidth : Ghosts

By RALPH W. HALLOWS M.A. (Cantab), M.I.E.E.

ONE meets not a few people who are firmly convinced not only that television with scanning of the 1,000-line order will be with us quite soon, but also that its coming will bring about an almost revolutionary improvement in the images provided by the domestic receiver. Some hold these views so strongly that they do not think it worth while to install 405-line sets in their homes: "Why buy what will soon become a museum piece when we are on the verge of such vast advances in technique?" To those who ask me when the advent of 1,000-line television is to be expected in the home my reply is one which will not, I am sure, go unchallenged by readers of *Wireless World*. It consists of just the one word: Never.

By that I do not mean that definition of the kind theoretically obtainable by the use of such a system will never be achieved in television broadcasting and reception. It certainly will be achieved some day—but probably not by the scanning methods which we now use, because we know of nothing better. Again, I do not contend that television systems with 1,000 scans to the image will never be developed. It is possible that they will, for use in theatres and cinemas. An 819-line service is, in fact, already in being in France. The crux of the matter is whether these so-called high-definition systems have anything to offer to the viewer in his own home; for the future of television is far more closely bound up with the home than with the hall or the theatre. Like sound broadcasting, it makes its strongest and widest appeal by virtue of its ability to provide entertainment in one's own house. Would 1,000-line television, if it came, improve domestic reception as dramatically and as radically as it would improve that in theatre or hall? That is an important question. It is one to which I have given a great deal of thought, besides spoiling much paper with calculations, the results of which may be of use to those who want a ready means of comparing the possibilities of existing or proposed television systems. The rather shattering conclusion which emerges is that 1,000-line television has nothing whatever to offer to the ordinary viewer! The term "1,000-line," by the way, is used in a general sense and to save the trouble of writing repeatedly "of the order of 1,000 lines"; the total of the scanning lines used in any interlacing system must, of course, be an odd number. Another point in favour of using the round figure 1,000 is that it simplifies calculations, without materially affecting the accuracy of the results obtained.

In any system of television one of the most important considerations is frequency: the range of modulation frequencies required and the carrier frequency. As the reader knows, the carrier frequency is largely determined by the width of the channel needed by a transmission: the greater the modulation bandwidth, the higher is the carrier frequency called for, if the transmission is to give and to receive sufficient elbow room.

The equation for the minimum range of modulation frequencies for balanced definition given in a previous issue of *Wireless World** may be conveniently rearranged in the form:

$$f_{min} = \frac{arpn}{2} L^2 \times 10^{-6} \text{ Mc/s} \quad .. \quad .. \quad (1)$$

where f_{min} = minimum modulation bandwidth to provide balanced definition
a = aspect ratio
r = ratio of whole line to active portion
p = ratio of active lines to total scanning lines
n = number of images per second
L = number of scanning lines.

Now in Europe, as well as in all countries in other parts of the world in which the periodicity of a.c. mains supplies is 50 c/s, n is a constant, its value being 25. All systems now use the 4 : 3 aspect ratio; hence a also is a constant with a value of 1.33. The remaining factors r and p differ so little from system to system that they, too, may be regarded as constants, at all events for something a good deal better than round-figure working. The values here are 1.2 and 0.93 respectively. Hence we have for transmissions with 25 images per second:

$$\frac{arpn}{2} = \frac{1.33 \times 1.2 \times 0.93 \times 25}{2} = 18.55$$

This gives the delightfully simple expression

$$f_{min} = 18.55L^2 \times 10^{-6} \text{ Mc/s} \quad .. \quad .. \quad (2)$$

The minimum modulation range for 1,000 lines leaps to the eye! Since 10^{-6} and 10^6 cancel out it is 18.55 Mc/s.

Carrier Frequencies

The total modulation range for the vision channel of a transmission is not twice the modulation bandwidth in modern systems, for one sideband is partially suppressed. For reasons outside the scope of this article complete suppression of this sideband is impracticable; but under working conditions about 75 per cent of one sideband can be fairly sharply cut off.

This means that the vision bandwidth of a balanced 1,000-line transmission is approximately 18.55 + 4.64 = 23.19 Mc/s. We may take the whole width of the sound-plus-vision channel required, including the necessary gap between it and the channel next above it, as not less than 26 Mc/s, which is getting on for 3,000 times that needed by a sound broadcasting transmission and over six times that called for by a 405-line television transmission. Only one balanced

*Television "Goodness Factor," *Wireless World*, March 1949.

1,000-line transmission could, in fact, be made on the entire 41-68 Mc/s range of frequencies now allotted to the B.B.C. for television.

For 1,000-line television, then, carrier frequencies very much higher than those now in use would be essential; frequencies probably of the order of 300-400 Mc/s. And once we get up into carrier frequencies of hundreds of megacycles per second and wavelengths measured in decimeters we begin to encounter problems in reception of new kinds.

The shorter the length of an electromagnetic wave, the more closely does its behaviour resemble that of light waves. Radio waves, for instance, are increasingly prone to reflection and to scattering as their length is reduced. It was precisely for that reason that shorter and shorter waves were used as radar developed, for the scattering of electromagnetic impulses by the "target" and their return as echoes are the basis of radar. But even in radar the shortening process cannot in the light of present knowledge be continued usefully beyond a certain point; otherwise scattering is caused not only by the wanted target, but by such a variety of unwanted targets—clouds, rough seas and so on—that clutter blinds the receiver.

Scattering, reflections and echoes can and do produce interference with television reception on 40-70 Mc/s. Far worse trouble is to be anticipated with carrier frequencies of 300-400 Mc/s. If the idea of wavelengths of one meter or less has conjured up visions of neat little dipoles, or H- or inverted V- or X-aerials in his mind, the reader must prepare for a disillusionment: it seems certain that elaborate, highly directional arrays would be needed if ghost images were to be avoided.

Reflections

Let us see how it works out. With a 1,000-line transmission the duration of a complete scanning line is $10^6/(10^3 \times 25) = 40$ μsec. That of the visible portion of the line is $40 \times 0.84 = 33.6$ μsec. With a 20 × 15in image (it would hardly be worth while to have anything smaller for 1,000-line reception) the speed of the spot over the screen is 33.6/20, or 1.68 μsec per inch. Hence a ghost displaced by 1/10th inch is produced by a reflected signal reaching the receiving aerial with a delay of 0.168 μsec. How much longer than the direct path from transmitter to receiver must the path of a reflected signal be to produce such a ghost? The velocity of e.m. waves through air is 1,000 yards per 3.05 μsec. The distance travelled in 0.168 μsec is thus $10^3 \times 0.168/3.05$ = approx. 55 yards: a reflection following a path 55 yards longer than the direct path produces a ghost displaced by 1/10th inch. Unless the image is viewed at a distance of nearly 29 feet (which would completely annul the beneficial effects of its higher definition) the displacement of such a ghost image subtends more than one minute of angle and is therefore within the resolving powers of ordinary eyes. In other words, at normal viewing distance one such ghost would destroy the horizontal definition.

One does not need to do much thinking in order to realize (1) that at comfortable viewing distances a ghost with a much smaller displacement would spoil the image; (2) that if the receiver is only, say, 10 miles from the transmitter a reflection from something very close to the direct path of 17,600 yards will give rise to a secondary signal with a path-difference sufficient to produce a ghost; (3) that in any kind of built-up area not one but many ghosts are to be expected, due to reflections from a variety of sources, including other television aerials; (4) that since the angles between the unwanted echo paths and that of the wanted direct signal may be very small indeed the directivity of the aerial serving the individual home would have to be of a kind difficult to achieve even with the most complex of arrays—particularly in view of the wide pass-band required.

So far as one can see, the only means of ensuring "clean" reception in any house, save that remote from other buildings, hills, pylons and tall trees, and itself destitute of all chimney stacks except the one carrying the television receiving aerial, would be to receive the transmissions at a master station, equipped with a complex aerial array and erected on a carefully chosen site, and to "pipe" them to the homes of subscribers.

But over what can they be piped? And what kind of subscription in terms of £ s. d. would be called for from the householder? To design and install transmission lines able to deal faithfully with bandwidths of the order of 26 Mc/s would be a formidable and a costly business, particularly because they would have, as a rule, to be of considerable length, since the site chosen on account of its freedom from sources of echoes for the master receiving station might be expected to be at some distance from any built-up area. One cannot make any exact estimate of the subscription which the "pipee" would have to pay; but it would undoubtedly be something rather heavy.

Suppose that all these problems had been solved, that we could transmit and receive 1,000-line images faithfully, that it had become possible to manufacture suitable big-screen television sets at prices within the reach of the ordinary man: should we then be so much better off as many imagine?

Let us see what a balanced 1,000-line image has to offer. The number of modulation cycles per whole line is f_{mod}/nL and that of the cycles per visible portion of line is f_{mod}/nrL, where f_{mod} is the modulating frequency in cycles per second. Taking n and r as constants as before, we have: modulation cycles per visible portion of line $= f_{mod}/30$L. Each whole cycle of modulation corresponds to two picture elements. Hence the number of picture elements per visible line is $f_{mod}/15$L and the number of picture elements per inch is $f_{mod}/15s$L, where s is the width of the image in inches. Calling the width, or horizontal diameter, of the picture element x, we have

$$x = \frac{15s\text{L}}{f_{mod}} \text{ inch} \quad .. \quad .. \quad .. \quad .. \quad (3)$$

From (3) we can find the minimum distance at which an image of a given number of lines can be viewed satisfactorily on a screen of given width. Notice that these calculations apply to any transmission, whether it is balanced, with $f_{mod} = f_{min}$, or unbalanced, with $f_{mod} < f_{min}$. In the latter case $x > y$, the height of the picture element, and therefore subtends a greater angle at the eye. The discrimination of normal good eyesight is accepted as being about one minute of angle. Since $\cot 1' = 3438$, the minimum viewing distance d is $3438x$, or

$$d = \frac{15s\text{L} \times 3438}{f_{mod}} \text{ in.}$$

Using the tangent of 1′ (which is 0.00029), we can simplify the expression to the form:

$$d = \frac{15s\text{L}}{f_{mod}\,(\text{Mc/s}) \times 290} \text{ in} \quad .. \quad .. \quad .. \quad (4)$$

For a given viewing distance in inches the maximum screen width in inches is :

$$s_{max} = \frac{f_{mod}\,(\text{Mc/s}) \times 290d}{15L} \text{ in} \quad .. \quad .. \quad (5)$$

The smaller living rooms towards which we tend to-day do not usually allow the viewing distance to be much greater than 8-9 feet ; let us call it 100 inches to simplify calculation.

From (5) we find that at 100 inches the maximum screen width for a 1,000-line image is 29.2 inches—say a $30 \times 22\frac{1}{2}$ inch image—which would probably be overlarge for comfortable viewing at such close quarters and would seem to point to a televisor, no doubt of the projection type, which might be a piece of furniture of rather unwieldy size. Alternatively, (4) shows that a 24×18 image built up by 1,000 scanning lines could be viewed, if one wished to do so, at approximately $5\frac{1}{2}$ feet.

If prospects for 1,000-line television are so barren, what of the 625-line standard, to which all Europe save this country and France, is now apparently committed ? The word " save " is used advisedly, for the projected 625-line systems are shown by cold, hard figures to be but poor pale travesties of television as it could and should be. From (2) above f_{min} for a 625-line transmission is : $18.55 \times 625^2 \times 10^{-6}$ Mc/s, or approximately 7.25 Mc/s. The accepted standard modulation bandwidth is 4 Mc/s ; hence the " goodness-factor," f_{mod}/f_{min} for such services is 4/7.25 = 0.55 — little more than half what it should be. And even that is likely to prove an ideal rather than a reality ; for, as readers know from experience, a pretty good receiver is needed to do justice to the 3-Mc/s portions of the B.B.C.'s faithfully transmitted test patterns . . . I will not labour the point.

The more one thinks over the subject, and the more paper one spoils with calculations, the stronger becomes one's conviction that, so long as scanning of the present type remains the sole practicable television method, progress is not to be made by increasing the number of lines. Research should be concerned, rather, with making the best use of the ranges of modulation frequencies which can produce in transmitter and moderately priced receiver a goodness-factor having the closest possible approach to unity. And that, in the light of present knowledge and technical achievement, leads inescapably to a scanning system, where 50-c/s mains supplies are involved, of the order of 400 lines. If we and the French could split our differences by adopting a common standard of (on our part) $405 + 16 = 421$ lines and (on their part) $441 - 20 = 421$ lines—an alteration which most existing receivers in both countries could take in their stride since it involves no more than line-hold adjustment—we might even yet show the rest of Europe that television progress in the immediate future is, and must be, closely linked with the adoption of a faithfully transmitted and faithfully received modulation bandwidth of the order of 3 Mc/s.

Radio on the Airways

Types of Navigational Aids Used on the Main Airlines

SINCE the inauguration of regular air traffic to and from this country there has always been a tendency for aircraft to follow fairly well-defined paths in the air. Navigation in fine weather offers no difficulties, but in conditions of poor visibility assistance from the ground in some shape or form has always been a pressing need. Radio has served this purpose, in one way or another, reasonably well, but with the ever-increasing density of air traffic it became apparent that some way would have to be found of controlling the flow of traffic to and from the main airports, and that the control would have to become effective, when conditions required, quite a considerable distance away from these termini.

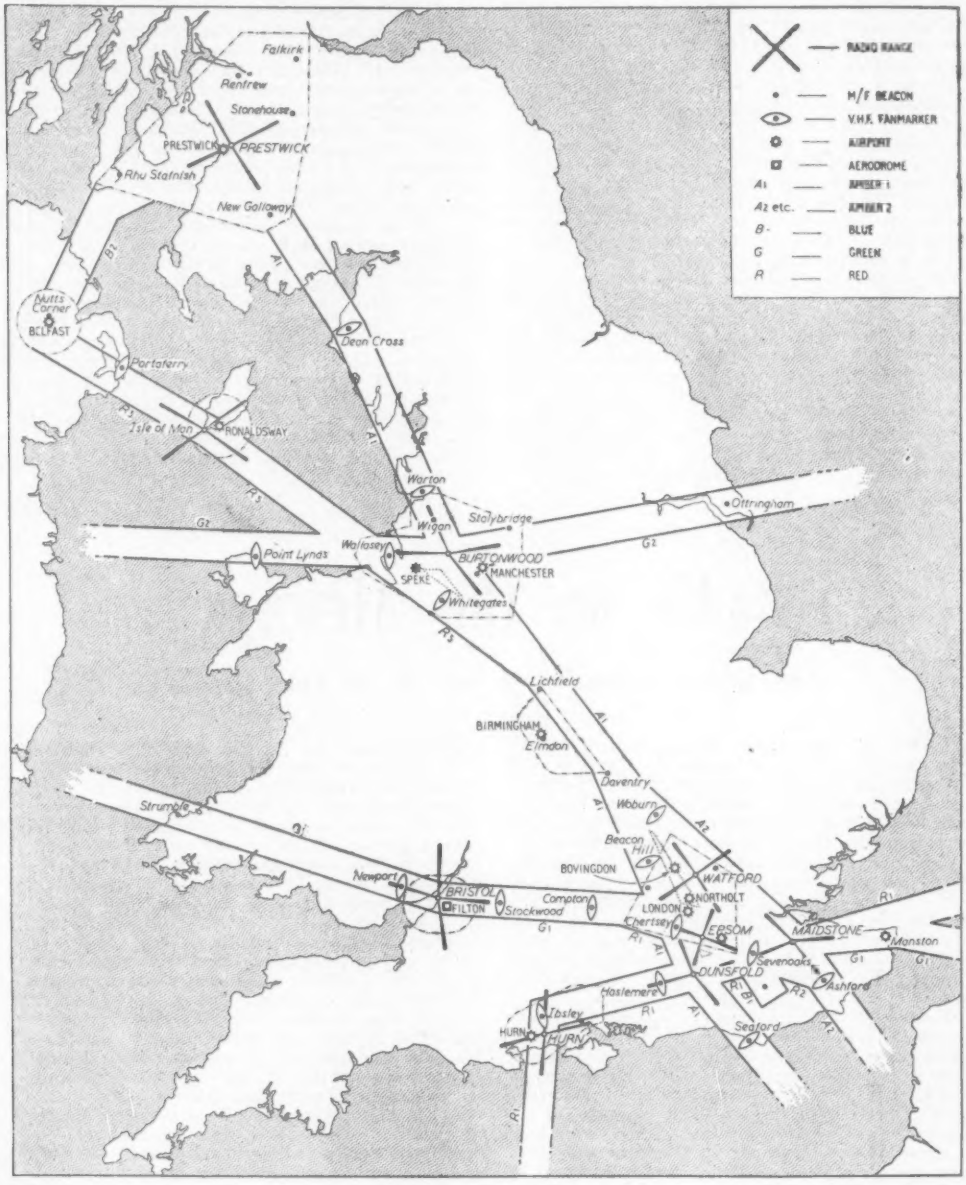
Thus there came into being a scheme which involved the laying down of a number of main trunk air routes, or airways as they are known, and equipping them with various radio aids to navigation so that pilots of aircraft, carrying only the barest minimum of radio apparatus, can safely negotiate the air lanes under all, or at least most, weather conditions.

These airways have, for identification purposes, been given the names of Red 1, Red 2, Amber 1, 2 and 3, Green, Blue, and so on, according to the direction they follow. As the map in Fig. 1 on the following page shows, they give direct access to most parts of the Continent, the Americas, and, so far as possible, avoid the main centres of population.

Radar also fits into the general picture, but its present use is limited to the immediate vicinity of the major airports. But here we are concerned only with the actual radio aids to navigation which the pilot in the aircraft (or his navigator) use to guide them into, and along, the airways. The principal equipments installed for this purpose are medium frequency omni-directional beacons, radio ranges, v.h.f. fan markers and " Z " markers. V.H.F. radio telephony also plays an important part in the scheme.

The m.f. omni-directional beacons, which operate in the 200- to 400-kc/s frequency band, are used as markers for the entrance to the airways; Strumble, Nutts Corner (Belfast), New Galloway, Ottringham and others located on or near the coast, to mention a few only, exemplify this application. These beacons radiate a tone-modulated signal which is periodically interrupted to give the identification letters of the station in morse characters. These beacons can often be heard at considerable distances, although for operational purposes they are rated as 10-, 25-, 50-, or 100-mile beacons, these being the service ranges as a radii from the stations for a signal strength of 60 mV ± 10 mV per metre at the service boundaries. As the map shows the omni-directional beacon is used also to mark the course of the airways, but this

function is more effectively performed by the radio range. It provides a well-defined path to follow and gives immediate warning of any deviation from the correct course and special equipment is not needed, the ordinary communications receiver being all that is required in the aircraft. D.F. equipment, or a radio compass, is needed to obtain the same information from the ordinary omni-directional radio beacons.



(Courtesy Ministry of Civil Aviation

Fig. 1. Map of the principal air routes in the United Kingdom with the type and position of the radio beacons installed and contemplated.

Radio range operates also in the medium frequency waveband and produces a signal which, while audible from all points of the compass, gives indication of a definite course in four directions only. Two types of radio range are in general use; one employs two crossed loop aerials (usually rectangular in shape) arranged at right angles to each other, while the other has vertical towers with the towers acting as the actual radiators. Both types give the same kind of signal in the receiver, but the transmitters are quite different.

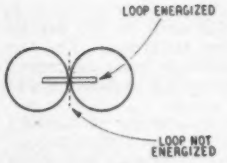
The crossed loop installation radiates a tone-modulated 1,020-c/s signal, each loop being energized alternately by a switching and keying system. If fed with the same power, each loop will have a "figure-of-eight" polar diagram in the horizontal plane, as shown in Fig. 2, and when energized alternately, and in suitable phase relationship, the radiation pattern round the station takes the form of two "figures-of-eight" at right angles, producing four zones of equal-strength signals spaced 90 deg. apart and bisecting the angles formed by the crossed axes of the individual loop patterns, as shown in Fig. 3.

In order to detect the equi-signal paths with an ordinary receiver the loops are not only energized alternately, but each is keyed to radiate a distinctive signal. One is keyed with the morse letter N and the other with A. The duration of the dots, dashes and spaces are so proportioned that if the two signals are received at exactly the same strength they interlock and give a continuous tone in the pilot's headphones.

At other points round the beacon either the A or the N signal will predominate and at a suitable distance there will be regions where either A or N only will be audible. The pattern in Fig. 4 shows the kind of signal that should be heard at different points of the compass round a radio range when each loop is so energized that it radiates a symmetrical pattern with equi-signal paths exactly at 90 degrees to each other.

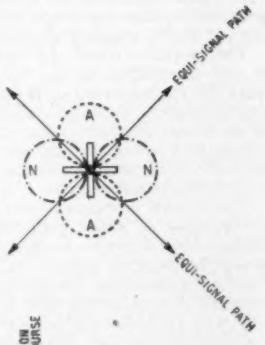
The principle of A and N interlocking signals is not new and it has been used in the past to produce path indication by navigational aids, but possibly this brief description of its application to radio range may serve to refresh the memory as the system has not been discussed at any length in recent times.

The other type of radio range used on the airways has vertical tower radiators, four such towers being arranged in a square with a fifth in the centre. Fig. 5 shows the type of towers employed. The four corner aerials are connected to one transmitter with diagonally opposite ones forming a separate aerial system similar to the four vertical sections of the crossed loops. Each system is fed alternately from a transmitter with unmodulated signals keyed in the one case with the morse letter A and in the other with the letter N. Interlocking occurs as already described and while it produces four equi-signal paths they could not be detected without some very special equipment. To overcome this, the fifth, or centre, tower is continuously energized by a separate transmitter having a frequency different from the other of 1,020 c/s. Heterodyning of the two signals in the aircraft's receiver produces the distinctive modulation tones of the crossed loop system. The pilot would not know by the sound of the received signal from which type of range it came but for the identification signals which are radiated periodically. The A and N signals are interrupted at intervals and an identification signal in morse characters substituted.

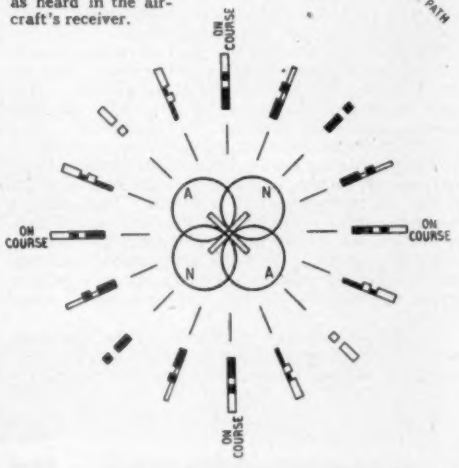


Left: Fig 2. Theoretical radiation pattern for one of the crossed loops of a radio range beacon.

Right: Fig 3. With the two loops (or four towers) of a radio range energized alternately and keyed with the morse letters A and N, four equi-signal regions are produced.



Below: Fig. 4. The all-round signal pattern of a radio range beacon. Both the crossed loop and the tower installations produce the same signal pattern as heard in the aircraft's receiver.



As the map shows, the four course markings of a radio range are rarely at right angles, but at some angle that throws some, or all, of its equi-signal paths along an airway. This is not accomplished by any change in the position of the loops, or towers, as once the station is erected any subsequent changes in courses brought about by additions or modifications to airways would be an expensive undertaking. In practice the aerials are erected quite symmetrically and the course path produced by the way in which the aerials are energized.

With the tower installations this can be done solely by electrical methods, it being necessary only to adjust the phase angle of the currents in the four towers. A goniometer system of feeding power to the aerials is employed and variations in phase are easily achieved by inserting suitable delay networks in the feed lines to each.

With the loop system conditions are somewhat different as the physical form of the loop precludes any

simple method of varying the phase relationship in opposite limbs of a loop; this must be 180 degrees unless some external influence intervenes. The fact that external bodies can modify the polar diagram of a loop is taken advantage of when it is required to shift the equi-signal paths of the system.

In radio range it is done by erecting an auxiliary aerial so that it couples closer to one vertical section of a loop than to the other. This causes a shift in the equi-signal paths and the amount of displacement is governed by the magnitude and phase of the induced current in the auxiliary aerial.

The extent to which the four paths can be shifted is well exemplified by the diverse courses needed to meet the requirements of the airways' scheme. If at any subsequent time it is required to shift the course of an airway the radio range can be modified to suit merely by resiting the auxiliary aerial (or substituting different delay networks in the goniometer), which is a relatively simple matter.

The average power of a radio range of the loop type is 100 watts r.f. output with 100 per cent tone modulation. Higher power is used for the tower installations, the central tower (the carrier frequency) is supplied with about 400 watts and the keyed towers (equivalent to modulation) with 275 watts or so. The last-mentioned equipment thus has a greater operational range than the loop installation.

Whilst a radio range tells a pilot whether or not he is keeping a true course along the airway, it does not give him any indication of his actual position. It is the same as direction finding on to a single station or beacon; one can get direction, but not position.

Position information is provided by a series of vertically radiating marker beacons, the radiation pattern being broad at right angles to the course of the airway, but narrow along its length. That relic of Victorian times, an opened fan standing vertical with its base on the ground and at right angles to the airway, will give a fairly good idea of the kind of radiation pattern achieved. And these beacons are appropriately termed fan markers and they have a power of about 100 watts.

The desired radiation pattern is obtained by using four half-wave horizontal dipoles mounted in line end-to-end (or collinear), one-quarter wavelength above a reflecting curtain of wire-netting and by suitable relationship of the currents flowing in the four dipoles. The reflecting curtain is not a fundamental part of the system as the ground itself would serve the same purpose, but by using the wire-netting reflector any distortion of the vertical radiated pattern due to inequalities of the ground, or even differences in vegetation, is avoided. A typical aerial installation for a fan marker is shown in Fig. 6.

In order to obtain the fan-shaped radiation across the airway the aerial system is erected so that the four collinear dipoles point *along* the airway. It is what is sometimes called a broadside array backed by a reflector.

These fan markers are tone modulated and each radiates identification signals in morse, so that the pilot can tell not only which airway he is on, should there be any doubt and this is most unlikely except at intersections of two or more airways, but also his exact position along the airway.

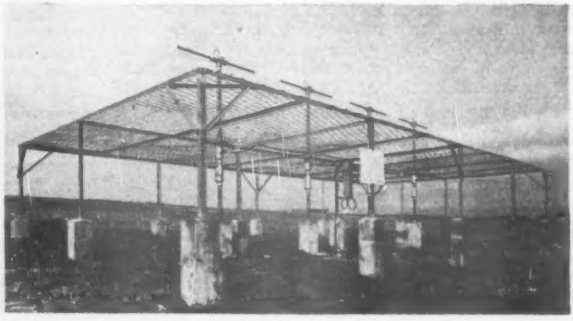
One other type of vertically radiating marker is sometimes used on the airways. It is called a "Z" marker and has a vertical cone-shaped radiation pattern with the apex on the ground. It is used to fill in the region of "no radiation" immediately above a radio range. They avoid complete cessation of signals when the aircraft passes over the range and, while not normally troublesome as an aircraft on a steady course would soon run into the signal zones again, the absence of signals might be a little awkward for aircraft instructed to make tight circles round a particular range while awaiting its turn to proceed into the area under the operational control of an airport.

Although figures have been given here for the r.f. power output of the various radio beacons it does not mean that all use the maximum. The power output of all transmitters is variable over a wide range, the fan markers, for example, can be used with 12 watts output or 100 and all beacons are set up and operated with just the amount of power needed to give a reliable service under all conditions. The majority are unattended beacons so that equipment is duplicated and automatic change-over to the stand-by takes place in the event of a failure. Suitable warning is passed over land-lines to the parent station of the beacon so that immediate steps can be taken to rectify the defect.

Left : Fig. 5. Two of the tower radiators used for one type of radio range.

Below : Fig. 6. Aerial installation for a fan marker. These operate on a frequency of about 75½ Mc/s.

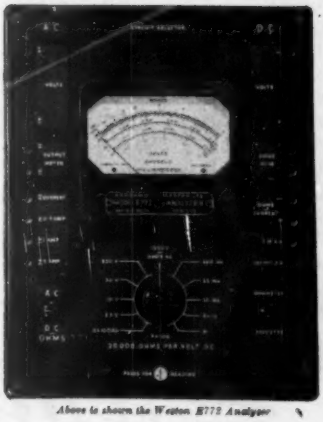
(Photos Courtesy Ministry of Civil Aviation



The same skill that produces the famous Weston Electrical Measuring Instruments assisted the record-breaking "Canberra"

Photograph by Charles F. Brown, F.I.B.P., A.R.P.S. who uses a Weston "Master" Exposure Meter

The same background of experience, sound design and fine workmanship that ensured the complete accuracy and reliability of the Weston instruments fitted to the record-breaking "Canberra" aircraft are built into every Weston Electrical Measuring Instrument, whether it be a switchboard or panel instrument . . . a sub-standard or first grade instrument . . . or a radio and television test set.



Above is shown the Weston E772 Analyser

WESTON ELECTRICAL MEASURING INSTRUMENTS

SANGAMO WESTON LIMITED

Enfield, Middlesex

Tel: Enfield 3434 (6 lines) & 1242 (4 lines) Grams: Sanwest, Enfield

Branches: Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Wolverhampton, Bristol, Southampton, Brighton, Liverpool, Nottingham

E.M.I. SPOT FREQUENCY MARKER

The most accurate Frequency Checking equipment yet designed!

★ *Write for full details of this and the complete range of special E.M.I. equipment for the Amateur.*

- Extended range from 1 Mc/s. to 200 Mc/s.
- Ex-Works, the accuracy is within .01%, but provision is made for setting the crystal against a suitable frequency standard permitting accuracy to be permanently maintained within a few cycles.
- Variations in H.T. supply between 150/250 volts will not affect the output frequency.
- The crystal harmonics on 144-146 M/c Band is sufficiently powerful to facilitate receiver alignment.
- Enables accurate calibration of Signal Generators, V.F.O.s and S.W. receivers.
- Price **£7 . 15 . 0** nett.

E.M.I. SALES & SERVICE LTD

CONTROLLED BY ELECTRIC & MUSICAL INDUSTRIES LTD

AMATEUR DIVISION

HEAD OFFICE: HAYES · MIDDLESEX · ENGLAND

E2118

By request

At the request of many of our constructor friends, we give here full details of the famous range of Stentorian chassis.

Type	Cone dia.	Flux Density (Gauss)	Pole dia.	Gap length	Flux face	Total flux	Speech coil Impedance (ohms)	Handling Capacity (Watts)	Prices	
									With Trans.	Without Trans.
*S.2.57	2½"	7,000	.375"	.033"	.093"	5,285	3	.3	—	17 3
*S.3.57	3½"	7,000	.625"	.035"	.125"	11,500	3	2	—	18 6
S.507	5"	7,000	.75"	.040"	.125"	14,000	3	2.5	1 8 0	19 6
*S.610	6"	10,000	.75"	.040"	.125"	20,000	3	3	1 11 9	1 3 6
S.707	7"	7,000	1"	.043"	.187"	27,650	3	3.5	1 14 0	1 3 6
S.810	8"	10,000	1"	.043"	.187"	39,500	3	5	1 17 3	1 6 9
S.912	9"	12,000	1"	.043"	.187"	47,400	3	7	2 3 6	1 13 0
S.1012	10"	12,000	1"	.043"	.187"	47,400	3	10	2 16 9	2 1 9
S.12135	12"	13,500	1.5"	.050"	.25"	106,000	15	15	9 6 9	8 3 6
S.1814	18"	14,000	2.5"	.0625"	.312"	227,000	12	30	—	24 0 0

Further details of these speakers and of the famous Concentric-Duplex models gladly sent on request.

* All Chassis material is of Mazak 3 except S.2.57., S.3.57 and S.610 which are of Drawn Steel.

WB *Stentorian* LOUDSPEAKER CHASSIS

WHITELEY ELECTRICAL RADIO CO. LTD · MANSFIELD · NOTTS

TEST REPORT

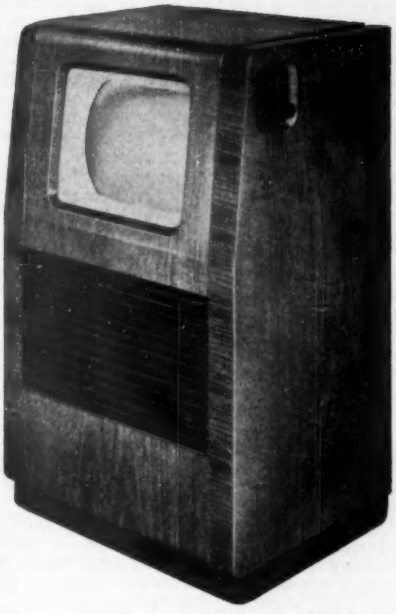
R.G.D. Television Receiver

Model L2351T

THIS receiver is of the console type with a 12-in tube and includes a four-station broadcast set as well as television. The L2351T is for London-area reception. It has three r.f. stages, a diode detector and one v.f. stage in the vision channel. Single-circuit couplings are used between the coaxial feeder and the first grid on the one hand and between the last r.f. valve and the detector on the other. Pairs of coupled circuits are used between the r.f. valves. The circuits are tuned to provide vestigial-sideband reception of the upper sidebands; that is, of those remote from the sound channel. As a result no special sound-channel rejector is needed and it suffices to tune the sound pick-out circuit for maximum sound-signal rejection in the vision channel.

This circuit comes after the first r.f. valve which is common to both signals. The sound channel itself has two r.f. stages with coupled pairs of circuits, a diode detector, diode noise limiter and an output valve. The noise limiter is of the usual series type which needs no adjustment. A switch is provided, however, by means of which the time constant can be increased if required. This permits better noise suppression to be obtained when interference is severe, but at the expense of sound quality. The volume control operates by varying the cathode bias on the r.f. stages.

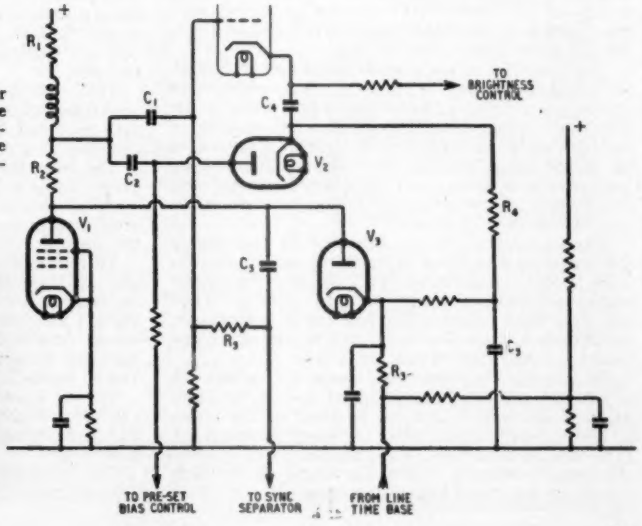
The vision-channel noise limiter is of an unusually complex form. The arrangement is shown in Fig. 1, in which V_1 is the v.f. valve. Its output is positive-going on the picture signal and that proportion developed across R_1 and the compensating inductance is applied to the grid of the c.r. tube through C_1. It is also applied through C_2 to V_2 and a somewhat larger amplitude of signal appearing across R_1 and R_2, directly to V_2. Both diodes are normally non-conductive.



General view of the receiver showing the controls.

The receiver front can be raised to expose the tube and the pre-set controls.

Fig. 1. Circuit of the vision-channel noise limiter.



A negative-going pulse is applied through R_3 to the cathode of V_3. This pulse is derived from the line time base and has a duration roughly equal to that of a line sync pulse and coincides with it in time. V_3 therefore has impressed on it simultaneously the sync pulse to its anode and the larger time-base pulse to its cathode. It therefore conducts and the quantity of electricity passed is proportional to amplitude of the sync pulse, and hence to the signal, and it builds up a proportional bias across C_2 which is applied through R_4 to the cathode of V_2. The diode V_3 and its associated circuit are merely a means of obtaining a bias voltage for V_2 which is proportional to the output of V_1.

This bias voltage keeps V_2 non-conductive unless the input to it through C_2 exceeds the peak-white level, as on an interference pulse. V_2 then conducts and the interference is passed to the cathode of the tube through C_4. On interference, therefore, the signal is passed to grid and cathode simultaneously so that the grid-cathode p.d. is unaffected.

The sync separator is fed from the anode of V_1 through C_5 and this circuit also acts to give d.c. restoration, the resulting bias being passed back to the tube through R_5. The sync separator comprises a pair of diodes which provide initial limiting of the signal. They are followed by a pentode limiter from the anode of which the sync pulses are fed to the line time base through a differentiator. A further pentode is used to produce the frame sync pulses.

The time bases each have a thyratron saw-tooth generator and a pentode amplifier. An adjustable linearity circuit is fitted to the frame amplifier and the output valve is transformer-coupled to the deflector coil.

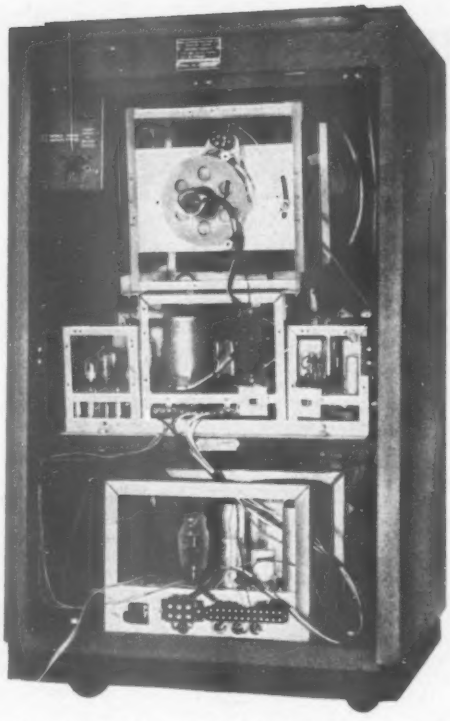
The line amplifier also comprises a pentode with transformer-coupling to the deflector coil. The linearity control is a variable resistor which, in series with a capacitor, is connected across the deflector coil. The deflector coil itself is of rather unusual type, for it has an iron core wound in toroidal fashion.

The e.h.t. of some 7 kV is produced by an r.f. oscillator and rectifier. The power supply comes from the mains through a transformer. The h.t. winding is tapped and two rectifiers are used to provide supplies at 260 V and 380 V, the latter being used for the time-base output valves.

The broadcast receiver is a separate unit with three valves and providing a choice of four pre-selected stations; its output is fed to the output valve of the television sound-channel receiver. It requires a separate aerial from the television one. Provision is made for the connection of a gramophone pick-up and there is a mains-outlet socket on the power unit from which the connections for a gramophone motor can conveniently be taken.

The mains controls are mounted on the side of the cabinet and comprise the mains on-off switch, contrast, focus, television-sound volume, broadcast-sound volume and station selector switch. When changing from television to broadcast it is necessary, in addition to operating the switch, to turn down one volume control and turn up the other.

By undoing two wing nuts inside the cabinet the top of the cabinet, with the upper half of the front attached, is released and can be lifted up for access to the interior. This enables the safety glass and the tube face to be cleaned and gives access to most of the pre-set controls. Since the whole of the back can be removed the accessibility is good.



Rear view of the set ; the broadcast receiver is the unit in the top left-hand corner.

On test, the set gave a very good performance, the brightness being adequate for daylight viewing under normal conditions. The synchronizing was exceedingly good, the settings of the hold controls being in no way critical. The 3-Mc/s bars in the test pattern were plainly evident. There was some evidence of circuit "ringing" when viewing the test card, but it was not sufficient to be noticeable on programme pictures.

The workmanship of the set is excellent and the appearance of the cabinet is pleasing. It is fitted with very easy ball "castors" and can be moved in any direction at a touch.

The construction is of unit form, the television set proper being in three units held together by a framework which also supports the tube. The broadcast receiver is a separate unit and the power unit is at the bottom.

There are 21 valves (counting double valves as one) plus the three of the broadcast receiver and the pre-set controls are: Sensitivity, Brightness, Sync, Line Hold, Line Amplitude, Line Linearity, Frame Hold, Frame Amplitude, Frame Linearity, Sound Interference Suppressor Switch, Vision Noise Suppressor, Vision Noise-Suppressor On-Off Switch.

The set is available with or without the broadcast receiver. Without it the price is 115 guineas plus £27 9s 5d Purchase Tax; the broadcast receiver costs £19 6s 8d.

The Birmingham-area model is type B2351T and is a superheterodyne but is otherwise identical.

SHORT-WAVE CONDITIONS

March in Retrospect : Forecast for May

By T. W. BENNINGTON*

DURING March the average maximum usable frequencies for these latitudes decreased slightly by day, and increased considerably by night. These are the normal seasonal variations from February to March, and the m.u.fs. should now continue to vary in these directions towards midsummer.

Daytime working frequencies were only moderately high. There was a long period of ionospheric disturbance about the middle of the month, when the higher frequencies were generally unusable. During the rest of the month, while, for example, 28 Mc/s was occasionally usable to the U.S.A., the highest useful frequencies were more often of the order of 22 Mc/s by day, and about 9 Mc/s after midnight.

There was a considerable decrease in the amount of Sporadic E observed during March. Sunspot activity was, on the average, at about the same level as during the previous month.

March was, on the whole, a somewhat less disturbed month than February. A prolonged ionospheric storm did, however, occur from 5th-17th, but apart from that the only other day of disturbed radio conditions was March 1st. A Dellinger fadeout was recorded at 1137 hrs. on the 24th.

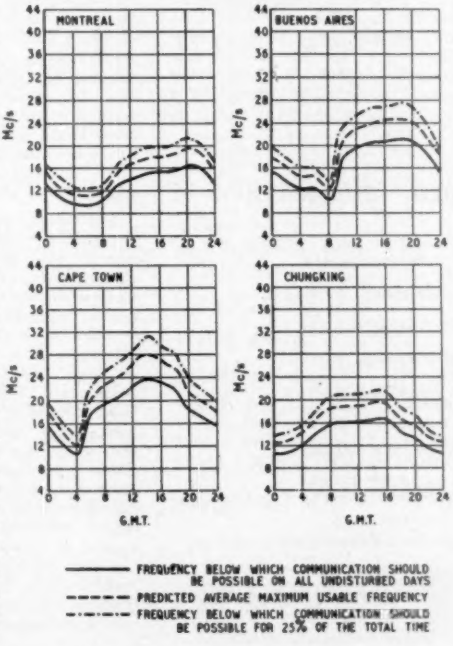
Forecast. — During May it is likely that the daytime m.u.f. for these latitudes will decrease considerably, and that the night-time m.u.f. will increase slightly.

The result of the ionospheric variations should be that the peak daytime working frequencies for long-distance communication will become lower over all circuits. Medium-high frequencies will, however, be usable for longer periods during the day and, over most circuits, frequencies as high as 9 Mc/s should be usable throughout the night. The highest regularly usable frequency for north/south circuits should be of the order of 22 Mc/s, and that for east/west circuits about 16-17 Mc/s.

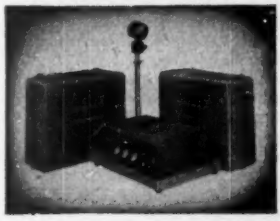
There will probably be a considerable increase in the rate of incidence of Sporadic E capable of sustaining high frequency propagation, and this may often permit medium-distance communication on, perhaps, the highest of the short-wave frequencies. Normal communication over medium distances will be controlled for several hours around noon by the E or F, layers, and during these periods the working frequencies will not be lower, but higher, than during the previous month. Ionospheric storms are not usually particularly frequent or troublesome during May.

The curves indicate the highest frequencies likely to be usable over four long-distance circuits from this country during the month.

* Engineering Division B.B.C.


MONTREAL
BUENOS AIRES
CAPE TOWN
CHUNGKING
Mc/s
G.M.T.
FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE ON ALL UNDISTURBED DAYS
PREDICTED AVERAGE MAXIMUM USABLE FREQUENCY
FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE FOR 25% OF THE TOTAL TIME

12-WATT PORTABLE MODEL U86/P



An improved type of AC/DC portable equipment in neat, compact form for utmost convenience in handling.
3-stage high gain amplifier with push-pull output and negative feedback, providing an output of 10-12 watts. Latest miniature valves. Operates on AC or DC equally efficiently. In addition to the amplifier the equipment includes two 8in. loudspeakers fitted in detachable parts of the carrying case, and a moving-coil microphone with folding stand. The amplifier has inputs for two microphones or microphone and gramophone, with mixing controls.
The whole equipment fits into a substantial portable case finished in leathercloth. Weight 30½ lbs. 14in. x 11½in. x 13½in. closed. AC or DC mains, 200/250 v. Consumption approx. 50 watts.

BATTERY/MAINS MODEL B619

For 12 v. or AC mains. Output 16-18 watts. Amplifier unit in metal case with carrying handle, operating in conjunction with small rotary generator in separate case, with simple plug connections. For AC mains operation a separate unit can be supplied. The additional expense and weight of this unit are saved, therefore, if the equipment is required for battery operation only.

Full details of these and other models in the large Trix range of Sound Equipment available on request. Send for latest catalogue and price lists.

THE TRIX ELECTRICAL CO. LTD.
1-5 Maple Place, Tottenham Court Road, London, W.1. *'Phone : MUSeum 5817*
Grams & Cables : "Trixadio, Wesdo, London."

AMPLIFIERS · MICROPHONES · LOUDSPEAKERS

RANDOM RADIATIONS

By "DIALLIST"

Automatic Monitoring

NOT LONG AGO I spent an interesting afternoon in the B.B.C.'s Designs Department seeing and hearing the recently developed Automatic Monitor at work and talking to two of its three joint originators, F. A. Peachey and C. Gunn-Russell. The automatic monitor—A-M for short—is designed to take over one of the most monotonous of human jobs, that of the engineer who sits at some distant point in a broadcasting network and makes the adjustments necessary to keep a signal as it reaches him as close as possible to what he imagines it must have been at its point of origin. The engineers doing this work at about a dozen points in the B.B.C.'s network must listen critically for long periods on end; a tiring business. Since there is no reference signal for comparison, the corrections they make must be to a great extent matters of personal taste and judgment, which is not altogether satisfactory. Even less satisfactory is the employment of a very considerable number of skilled engineers on tasks of this kind. The A-M will soon be taking over much of this work. The way in which it works is very briefly this. Most of the defects to which a signal is liable in its passage over a long cable can be made to appear as abnormal rises or falls in voltage. The A-M is supplied with a reference signal and makes continuous electronic comparisons between this and the line (or compared) signal. This is done by means of a bridge arrangement and a differential detector, to the valves of which both voltages are fed. So long as they are equal, or nearly so, nothing happens. But any serious unbalance is at once shown up by the ringing of a bell, served by a relay, and by movements of the pointer of a galvanometer.

The Next Step?

You will see that this does not quite eliminate the engineer. Someone has to be there to take action when A-M calls for it; normally, though, adjustments and corrections are needed only at fairly long intervals, so that the engineer can go on with his own work, leaving it only at those moments when A-M summons him. This is a big step forward, but I imagine that in time another development will be made. If A-M now operates, as it does, a relay which causes the bell and the galvanometer to indicate by their behaviour not only the existence of a fault but also what kind of fault it is, it should surely be possible to develop an electronic device which would interpret these signals *and* take the necessary action. It is a complicated problem and its solution will take time, but no doubt one day the fully automatic monitor will appear.

The Eutectic

I GATHER THAT a good many readers have been as puzzled as I was when I first came across the term "eutectic," which is always cropping up in articles on soldering. My own acquaintance with the mysteries of metallurgy being of the slightest, I consulted friends who do know something about it. From these I gather that the eutectic is the combination of the two metals forming an alloy with the lowest possible melting point. And that melting point appears to be always considerably below the melting point of either of the constituent metals by itself. The term melting point here means the temperature at which the metal becomes entirely liquid. The soft solders used for most purposes are alloys of tin (melting point 232° C) and lead (melting point 327° C). Suppose that you started with pure lead, went on adding tin to it and recorded the temperature at which each combination of the two metals became liquid. An alloy of 10/90 (that is 10% tin, 90% lead—the tin is always written first) would liquefy at a little below 320°, one of 20/80 at about 300°, and one of 30/70 at 275°. The fall in the melting point temperature would continue until the proportions were 63/37, when it would be 183°. From then onwards the addition of further tin would send the melting point up.

Back to Tubal Cain?

The eutectic of the tin-lead alloy is, then, 63% tin and 37% lead; eutectic solder has these proportions of the metals. The commercial soft solder used for so many radio jobs may be described as near-eutectic, for it is the 60/40 alloy which is found satisfactory from both manufacturers' and users' points of view. As S. J. Nightingale and O. F. Hudson have mentioned in their excellent book "Tin Soldiers," the craftsmen of the middle ages (and very probably those of much earlier times) discovered by trial and error how to make something very like eutectic for use in tinsmith's work. This was known as "two-and-one," that is, two parts by weight of tin to one of lead, or 66/34. Some families of tinworkers, no doubt, had their own special recipes, such as "seven-and-

ASSOCIATED ILIFFE TECHNICAL BOOKS

"WIRELESS WORLD" PUBLICATIONS

	Net Price	By post
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 3rd Edition	18/-	18/8
SHORT-WAVE RADIO AND THE IONOSPHERE. T. W. Bennington. 2nd Edition	10/6	10/10
WIRELESS SERVICING MANUAL. W. T. Cocking, M.I.E.E. 8th Edition	12/6	12/11
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 5th Edition	15/-	15/6
BASIC MATHEMATICS FOR RADIO STUDENTS. F. M. Colebrook, B.Sc., D.I.C., A.C.G.I. 2nd Edition	10/6	10/10
WILLIAMSON AMPLIFIER: Articles on Design of a High-quality Amplifier	3/6	3/9
RADIO DATA CHARTS. R. T. Beatty, M.A., B.E., D.Sc., 5th Edition—revised by J. McG. Sowerby, B.A., M.I.E.E.	7/6	7/11
TECHNICAL INSTRUCTION FOR MARINE RADIO OFFICERS. H. M. Dowsett, M.I.E.E., F.Inst.P. L. E. Q. Walker, A.R.C.S. 9th Edition	60/-	61/-

A complete list of books is available on application

Obtainable from all leading booksellers or from

ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1.

four" (64/36) or three-and-two (60/40), which were passed on from father to son. Where harder solders were needed these were close to the one-and-one (50/50) ratio. The traditional alloy for the hardest of the tin-lead kinds was "one-and-two," known as plumbers' solder and very like the 40/60 of to-day.

Knee-Deep in Terminals

MY VERY BEST THANKS to those kind readers who have sent me examples of what they consider ideal terminals for radio or general electrical purposes. At first they trickled in; then the trickle became a river and the river a flood. The last time I met the Editor he enquired whether I had safely received the hundredweight or so that he had sent on to me a few days before! It has not been possible for me to write personally to all who showered actual terminals or drawings or descriptions upon me; I am sure they will understand and forgive. Some of those who sent drawings or descriptions asked whether it would be worth their while to take out patents. Frankly, I doubt it. To be successful, a new idea in such things as terminals must offer something so obviously and outstandingly better than familiar types that it will completely outclass them. Only in that case is it likely to be worth while for a manufacturer to install the tools required for the new device and to write off his existing equipment as scrap. That is a point that inventors often fail to grasp.

MANUFACTURERS' LITERATURE

Components and Accessories by Clix catalogued in a booklet from British Mechanical Productions, Ltd., 21, Bruton Street, London, W.1.

E.H.F. Aerials; a folder of illustrated leaflets from G.S.V. (Marine & Commercial), Ltd., 395, High Street, Chatham, Kent.

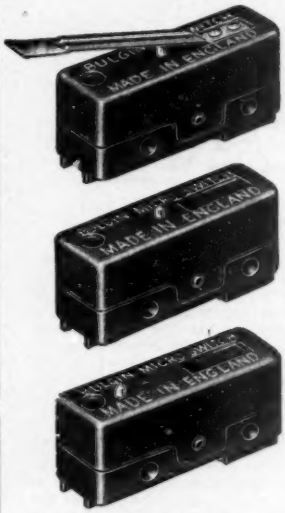
Cold Pressure Welding; the latest developments described in a new illustrated brochure from The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Capacitors catalogue C263 available to manufacturers from A. H. Hunt, Ltd., Bendon Valley, Garratt Lane, Wandsworth, London, S.W.18.

Cables for broadcast relaying and sound distribution catalogued in a leaflet from The Telegraph Construction and Maintenance Co., Ltd., 22, Old Broad Street, London, E.C.2.

BULGIN OFFERS ASSURED QUALITY

Only the finest quality materials are used in the manufacture of *Bulgin* components, and every *Bulgin* product is guaranteed against electrical and mechanical faults.

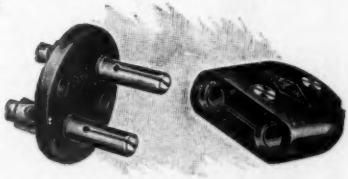


THESE MICRO-SENSITIVE SWITCHES

Represent the finest of this class of switch. Their action is simple, yet reliable and trouble-free, and their performance is consistent and very long lived. All the internal springs are of the best hardened beryllium-copper alloy, and the heavy contacts are of pure silver. The action is precise and snappy. Fitted with rustless steel operating buttons also with spring-leaves externally. Cases of moulded thermo-setting "Bakelite" material, standard finish black. Each model is S.P.C.-O., universal for on-off or C.-O. uses, with 6 B.A. terminals at the base, optional with solder-tags, and marked with the relaxed (non-operated or free) contacting. Rated (all ratings at 50~) for 10A., 60-125 v. ~, 5A., 130-250 v. ~ (also 2.5-2A. 260-500 v.~ for types with 0.04in. and 0.07in. contact gaps. Those with 0.01in. contact gaps are limited to 250 v. max.) De-rateable for peaky—or high-transient—circuits and D.C. uses. Max. working V. to E., 500 R.M.S. Fixing (transverse to direction of operation) 2 × 4 B.A. clear at 1in. (±.005in.) c.r.s. O.A. dims. 1.15/16in. × 11/16in. × 27/32in. high (± button projection of .05in.-.06in. average), all ±1/64in.I.R. measured @ 2 KV. R.M.S. max.

PLUGS & SOCKETS

List No. P.19. This excellent mains connector has 5-A size pins and sockets (member with the pins is termed "Plug"). Fully shrouded in polished, moulded "Bakelite" material, with 6 B.A. terminals for connection and adequate cord gripping arrangement. A safe and reliable mains connection for all classes of electronic equipment.



List No. P.200 and P.260. Mounting Plug: 2 × 4 B.A. clear at 1⅛in. c.r.s. with central aperture 1in. × ⅝in. approx. to clear polar parts. Socket: 2 × 5/16in. ⌀ at 1⅛in. c.r.s. with central 15/16in. ⌀ hole; thickness of fixing, up to ⅛in.

List No. P.21. Baseboard or top of chassis mounting, terminals to both plug and socket. Moulded in thermo-setting "Bakelite" material. Mounting of plug: Bracket; 2 × 6 B.A.—clear holes at 25/32in. centres on ⌀.

SEND FOR 80 PAGE CATALOGUE 185/WW
PRICE 1/- POST FREE
MANUFACTURERS OF RADIO & ELECTRONIC COMPONENTS

BULGIN Components
A.F.BULGIN & CO.LTD
BYE-PASS ROAD BARKING
TELEPHONE Rippleway 3474 (3 lines)

UNBIASED

By FREE GRID

Radio Mummy-Making

APPLIED science in all its branches has made enormous strides since the day when Mr. Sowerberry, the undertaker, took young Oliver Twist into his employ to initiate him into the mysteries of this very necessary calling. It does not surprise me, therefore, to learn from the pages of *Tele-Tech* (February, 1951) that diathermy—one of the many ramifications of radio technique—has been brought into use by Chicago undertakers, or morticians as they call themselves without regard to the sinister literal meaning of this horrible hybrid word which is so very apt in this famed city of gangsters and sub-machine guns.

Diathermy is being used for desanguinating and dehydrating defunct Chicagoans, thus embalming them and enabling them to be kept in prime condition for two million years. The only comment I have to make is that the whole business leaves a nasty taste in my mouth, more especially when I remember

"A nasty taste"

that Chicago is also the centre of the meat-canning industry.

Radiotelearchics in 1915

A FEW months ago (October, 1950) I told you that I had fitted my car with a v.s.w. transmitter whereby I was enabled by a very simple and obvious application of telearchics to open the garage doors and at the same time fill the house with light, warmth and the smell of sizzling kippers each night while still a mile or so from home. A correspondent, who with Micawber-like patience and persistence has read this journal steadily from the first number, tells me that he has been enabled to do this and more, also, solely by carrying out ideas put into his head by an item of news he read in the November, 1915, issue of *W.W.*

He stresses that in one respect he

"Desperate slimming measure"

did more for his comfort by remote radio control in 1920 than I did for mine thirty years later. He lives in a house not provided with a garage and has to rent one some distance away. But, in the depths of winter he has, since 1920, started his car engine by radio telearchics while still at home so that it is nicely warmed up by the time he gets round to the garage.

It was astonishing to me to read that car engines were started by remote radio control as far back as 1915, and yet on taking down the appropriate issue of *W.W.* from my library shelves I see that my correspondent is correct. I presume that the only reason why he waited from 1915 to 1920 to use this idea was the restrictions imposed during the war years.

I must say that I had forgotten this news item in *W.W.* Happily, I am not compelled to clutter up valuable ether space in this manner as my garage adjoins my house and I could, if necessary, start the car by ordinary electrical means, but do not actually do so as Mrs. Free Grid warms both the car and herself by using the handle in winter and summer as a voluntary and desperate slimming measure.

Amateur Radio in 1898

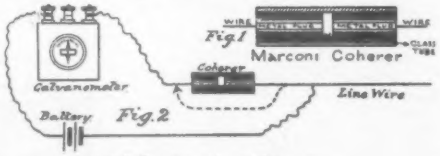
IN the February issue, when discussing the question of the publication of the first constructional article for a wireless set, I stated that I had personal knowledge of one which appeared in 1911 but felt that this was not the earliest. Actually, I expected, as a result of what I said, to hear of some article being published about 1907, but certainly not very much earlier. I have, therefore, been greatly astonished to learn from a reader that one appeared in the first issue of *The Model Engineer* which was born in January, 1898, and is still going strong. By permission of the Editor of that journal, we reproduce a diagram from the article which was entitled "The New Wireless Telegraphy: Some Interesting Experiments for Amateurs" and was given pride of place in the issue.

The article is not of the type giving complete constructional details such as we were used to in the twenties and thirties but deals with the construction of both transmitters and receivers in broad outline, giving the reader a choice of several different arrangements. A range of two *feet* is claimed using the make-and-break of an electric bell as a spark transmitter, while, with a six-inch induction coil, the range is more than quadrupled to three yards. These ranges seem a little conservative but it is only fair to point out that neither aerial nor earth were used and the writer states that for long-distance work these are necessary for both transmitter and receiver.

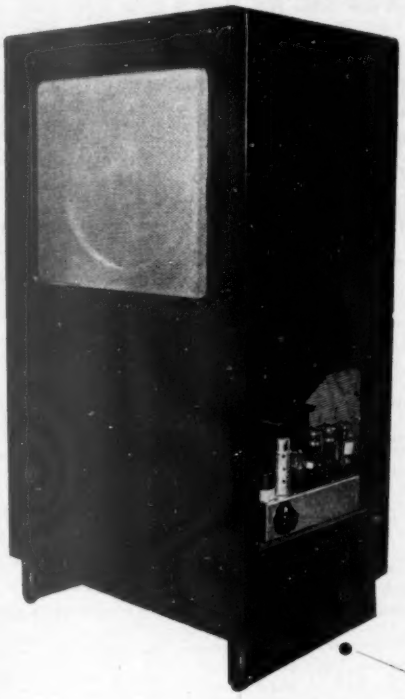
I think that the most surprising thing about the article is that it shows how hard the amateurs pressed on the heels of the professionals even in those early days; in later times, of course, notably in the years following the 1914-18 war, we find them leading the professionals as they bridged not only the Atlantic but the 12,000-odd miles between here and the Antipodes using wavelengths given to them by the "totalitariocrats" of St. Martin's-le-Grand solely because it was thought that these short waves were of not much practical use.

How closely the amateurs followed the professionals can be realized when it is recalled that the article in *The Model Engineer* was published only six months after the formation in July, 1897, of the first commercial wireless company, The Wireless Telegraph and Signal Co., which, like the amateurs, still flourishes in 1951, but as Marconi's W.T. Co.

I have little doubt that "amateur" wireless experimenters were at work long before 1897, but surely one is not justified in using the word "amateur" before professionalism has started.



1898 Constructional Diagram.



THE NEW

B. B. C. MONITOR LOUDSPEAKER UNIT*

USES A

LEAK TL/12 AMPLIFIER

* *B.B.C. Pat. Application No. 24528/49*

Enquiries for this equipment are invited from overseas broadcasting and recording companies and film studios.

Professional and home applications of the TL/12 amplifier and the new RC/PA/U pre-amplifier are described in a new booklet, W/U, available shortly from your dealer or from us.

H. J. LEAK & CO. LTD. (Est. 1934), Brunel Rd., Westway Factory Estate, Acton, W.3

Phone: SHEpherds Bush 1173/4 Telegrams: Sinusoidal, Ealux, London Foreign: Sinsoidal, London

D. COHEN

RADIO & TELEVISION COMPONENTS

MAINS TRANSFORMERS

Primary 200-250 v. P. & P. on each 1/6 extra.
250-0-250, 100 mA., 6 v. 3 amp., 5 v. 2 amp. Upright mounting, **17/6.**
250-0-250, 60 mA., 6 v. 4 amp. (to be used on common heater chain with 6 x 5 rectifier). **13/6.**
280-0-280, 80 mA., 6 v. 3 amp., 4 v. 2 amp., drop-through, **14/-.**
Drop thro' 350-0-350 v. 70 mA. 6 v. 2.5 amp., 5 v. 2 amp., **14/6.**
Semi-shrouded, drop-thro' 280-0-280 6 v. 3 amp., 5 v. 2 amp., **16/-.**
Semi-shrouded, drop-thro' or upright mounting 280-0-280 80 mA., 4 v. 6 amp., 4 v. 2 amp., **12/6.**
Auto-wound H.T. 280 volts at 360 mA., 4 v. 3 amp., 2 v. 3 amp., or 6 v. 3 amp. Separate 4 v. 3 amp. rectifier winding (upright or drop-thro'), **10/6.**
350-0-350 v. 120 mA., 4 v. 6 amp., 4 v. 3 amp., drop-through, **21/-.**
Auto-transformer, various combinations of voltages including 110 v. 70 watt, and 3/4 volts windings at 1 amp., 2 volt 1 amp., drop-through or upright mounting, **10/6.**
Heater Transformers Pri. 200-250 v., 6 v. 1½ amp., **6/-.** P. & P., each 9d.

ELECTROLYTIC CONDENSERS

50 mfd. 50 work, **1/9**
100 mfd. 12 v. work, **1/3.**
16-16 mfd. 450 work, **4/-**
50 mfd. 12 v. work, **1/-.**
25 mfd. 25 v. work, **1/2.**
16 × 8 mfd. 450 work, **4/-.**
8 mfd. 450 v. work, **1/11.**
250 mfd. 12 v. work, **1/3.**
16 mfd. 500 v. **4/-.**
8 mfd. 500 v., **3/-.**
8 × 8 mfd. 450 work, **3/6.**
32 mfd. 350 work, **2/-**
32 + 32 mfd. small tube tag ends 200 v. work, **2/-.**

P.M. SPEAKERS

	with trans.	less trans.
3½in.	—	10/-
5in.	14/-	11/6
6½in.	14/6	11/6
8in.	16/-	13/6

5in. Energised 750 ohm field with O.P. trans., **13/6.**
P. & P. on each of the above 1/- extra.

THIS MONTH'S OUTSTANDING OFFER

6½in. permanent magnet speaker, flux density 8,000 lines, heavy magnet, by famous manufacturer, speech [coil impedance 2 ohms. These speakers are new and unused but the cones have come unstuck from side of chassis. Each guaranteed not out of centre. **7/6** post paid.

COIL PACK. 3 wave band, 16-50 metres, 180-550 metres, 1,000-2,000 metres. Iron cored coils, I.F. frequency 465 kc. Size 3½" long, 2⅛" deep, 1⅞" high, complete with circuit diagram, tax paid 21/-. Post paid.

OUTPUT TRANSFORMERS. Standard type 5,000 ohms imp., 2 ohms speech coil, **4/9** ; Push-Pull 6 v. 6 matching 10 watt 2 ohms speech coil, **6/9.** Miniature type to suit 155, **5/-.**

SET OF 3 BROWN KNOBS marked "wave change," "tuning," and "volume" **1/6.**

MIDGET COMPONENTS. Twin gang ⅝in. diameter, ⅝in. long. (The dimensions of this gang are slightly deeper than a standard volume control.) Pair Medium and Long iron cored T.R.F. Coils ⅝in. long × ⅝in. wide complete with a 4-valve all dry circuit. Both above items **8/6,** post paid.

ALL DRY A.C. MAINS SUPPLY UNIT, size 3½in. long × 2⅝in. wide × 1⅝in. deep. We can supply a complete all-dry circuit, using the above Midget Components to incorporate the above Power Unit, **19/6,** post paid with circuit.

MIDGET BAKELITE CABINET. 7in. × 5½in. × 5in. c/w. 5-valve S/H. chassis med./long wave scale and back (takes std. twin gang condenser and 3½in. speaker), **15/-.**

LINE AND FRAME COIL ASSEMBLY. Frame coils wound but not fitted (full instructions supplied). High impedance frame ; low impedance line, matching 5-1, **8/6.**

PRE ALIGNED MIDGET 465 Kc. Q.120, **9/-** per pair, post 6d.

MINIATURE 465 Kc. I.F.s. Type M400B. **12/6,** plus 6d. post and packing.

MINIATURE 465 Kc. I.F.s (slightly larger than the above item) Q.120, per pair, **10/-.**

IRON CORED 465 Kc. I.F.s. Q.130, 2⅛in. × 1⅛in., per pair **6/-.**

IRON CORED 465 Kc. WHISTLE FILTER, screen, each **2/-.**

VALVE HOLDERS. Paxolin International octal, **4d.** each. Moulded International octal, **6d.** each. EF50 ceramic **7d.** each. Moulded B7G slightly soiled **6d.** each.

LINE CORD. 3-way 0.3 amp., 180 ohm per yard. **1/3** per yard.

CERAMIC P.F.S. 3 each of the following : 330, 220, 180 and 82, **2/6.**

TRIMMERS. 5-40 pf., **5d.** ; 10-110, 10-250, 10-450 pf., **6d.**

TWIN GANG .0005 TUNING CONDENSER. **5/-.** With trimmers, **7/6** Post and packing, 6d.

TWIN GANG MIDGET .00037 with perspex dust cover and trimmers, **8/6.** Post and packing, 6d.

MAINS DROPPERS. 0.3 amp., 460 ohms, tapped 280 and 410, **1/6** ; 0.2 amp., 717 ohms, tapped at 100 ohms, vitreous, **1/6** ; 0.3 amp., 950 ohms, tapped 700 and 825, **2/6** ; 0.2 amp. 1000 ohm, vitreous, tapped, **2/6.** P. & P. on each, 3d.

VOLUME CONTROLS, by famous manufacturer. Long spindle and switch, ¼, ½, 1 and 2 meg., **4/-** each. 20, 25 and 50 k., **3/6** each. Post and packing 3d. each.

VOLUME CONTROLS, by famous manufacturer. Long spindle less switch, 5 k., 50 k., 500 k., 1 meg., **1/9** each. Post and packing 3d. each.

5-VALVE A.C. MAINS, 200-250 v., 3 wave-band superhet chassis. 1,000-2,000, 200-500 and 16-50 metres. By very good manufacturer, complete with valves. 6K8, 6K7, 6Q7, 6V6 and 5Z4. Size of chassis 11½ × 7½ × 2in. Size of glass scale 8¾in. × 7½in. with pick-up sockets (takes 8in. P.M. with trans.). TAX PAID, **£8/18/6.** Post and packing 2/6.

GOVERNMENT SURPLUS. Removed from equipment but guaranteed :
Metal Rectifier, 230 v. 60 mA., **4/-.**
Metal Rectifier, 230 v. 80 mA., **5/-.**
Metal Rectifier, 300 v. 100 mA., **6/6.**
Post and packing on each, 6d.
8 mfd. metal cased, 450 v. work, with clip, **1/-** each.

WAVE CHANGE SWITCHES. 6-pole 3-way, **2/-** ; 3-pole 2-way, **1/2** ; 4-pole 3-way, **1/9** ; 5-pole 2-way midget, **1/9** ; Post and packing 3d. each.

MINIATURE BUTTON NEON INDICATOR, complete with brass batten holder 200/250 v., **2/-.**

TELEVISION MASKS

White Rubber. 9in. with glass **10/6.** White Rubber. 12in. with glass, **15/-.** 15in. white rubber mask, soiled, **12/6,** plus 1/- P. & P.

CONSTRUCTOR'S PARCEL comprising : 5-valve superhet chassis with I.F. trans. and V/H. cut-outs, 13⅜in. × 6in. × 2in. with L.M.S. scale 7in. × 5in., back plate and two supporting brackets. Drive drum, spindle and pointer, mains trans. G.E.C. 350-0-350 70 mA., 6 v. 2.5 amp., 5 v. 2 amp., and Plessey 8in. M. energised 2,000 ohm field with 5,000 ohm impedance, O.P. trans., **32/6.** Post and packing, **2/-.**

CONSTRUCTOR'S PARCEL comprising : 5-valve superhet chassis with I.F. trans., and V/H. cut-outs, 13⅜in. × 6in. x 2in. with L.M.S. scale 7in. × 5in., back plate and two supporting brackets. Drive drum spindle and pointer, **7/6.** Post and packing 1/6.

CONSTRUCTOR'S PARCEL comprising : twin gang with feet, pair long and medium iron cored T.R.F. coils, 4 octal V/H., 3-pole 2-way switch Erie 20k. pot. w/s., heater trans. 220-240 v. 1 amp., 2 yds. flat silk flex, 3 black knobs, chassis 10½in. × 5½in. × 2in. with speaker and V/H cut-outs, metal rectifier 60 mA., 230 v. and 32 + 32 mfd. 200 v., **19/6,** post paid.

CONSTRUCTOR'S PARCEL comprising : Chassis 10½ × 5½in. × 2in. with speaker and valve holder cut-outs, R. and A. 6½in. P.M. with transformer, twin gang with feet, pair medium and long wave iron cored T.R.F. coils. Four International Octal valve holders, wave-change switch and Erie 20k pot with switch, **25/-,** plus 1/6 post and packing.

CONSTRUCTOR'S PARCEL comprising chassis 10½in. × 5½in. × 2in. with speaker and valve holder cut-outs ; Rola 5in. P.M. with O.P. trans. ; twin-gang with trimmers ; pair of T.R.F. coils ; Four international Octal valve holders ; wave change switch and Erie 20k pot, with switch. **19/6** plus 1/6 post and packing.

CONSTRUCTOR'S PARCEL comprising : Midget twin-gang with slow-motion drive ; pair midget 465 Kc. I.F.s ; frame aerial ; medium wave osc. coil and layer type H.T. and L.T. batteries 90 v. × 1½ v., and midget chassis, **21/-,** plus 2/- post and packing.

CONSTRUCTOR'S PARCEL comprising : 5-valve superhet chassis with transformer cut-out, size 13⅜in. × 6in. × 2in., with L.M. and S. scale, size 7in. × 5in. Back plate, two supporting brackets, drive drum, pointer, two-speed spindle, twin gang condenser. Mains transformer 250-0-250 v. 60 mA., 6 v. 4 amp. Pri. 200-250, 6½in. speaker and 6 × 5 rect. **35/-** plus 2/- post and packing.

Terms of business:—Cash with order. All enquiries must be accompanied by stamped addressed envelope.
PLEASE NOTE—Regret no orders accepted from outside United Kingdom.

POST ORDERS ONLY

67 RALEIGH AVENUE, HAYES, MIDDLESEX

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

STOCKS ARE RAPIDLY DIMINISHING

BUY NOW, BEFORE IT IS TOO LATE

CATHODE RAY TUBES

Thermal Delay Switches: **CV190, 6/6.**

Receiving Valves: Type **956, 2/6** each **20/-** per dozen. Type **958A, 3/-** each, **24/-** per dozen. Types **9004, 9005, 3/6** each.

V/M Pentodes **CV 1124** (MSPEN), 4 v. 7-pin base, **5/-** each, **36/-** per dozen.

C.V. No.	Civil'n No.	Dia. in inches	Focus	Defn.	EHT	O.K. for T.V.	Price	Rail, Pkg. & Insur.
600	5CP1	5	E.S.	E.S.	2 kV.	Yes	25/-	2/6
953	—	5½	Gas	E.S.	1500 v.	No	17/6	2/6
1596	—	4½	E.S.	E.S.	1200 v.	Yes	25/-	2/6
—	VCR528	11.5	E.S.	Mag	6 kV.	No	60/-	12/6
1384	—	11.5	E.S.	E.S.	4 kV.	Expmtl.	40/-	10/-
1516	VCR516	9	Mag	Mag	5 kV.	No	40/-	10/-
1522	VCR522	1.75	E.S.	E.S.	800 v.	Yes	15/-	1/6
2880	EM14/1	3	E.S.	E.S.	800 v.	Yes	17/6	1/6
3776	—	5.25	E.S.	E.S. Mag	4 kV.	Expmtl.	20/-	2/6

5CP7 C/R Tubes **50/-**, plus **5/-** carriage, packing and insurance.

Mercury Vapour Rectifiers. Type **CV1262** (G.U.I.) **7/6.** Type **CV1072** (G.U.50) **7/6.**

EHT Rectifiers. Type **2X2/879, 2/6** each, **20/-** per dozen.

VCR 517C C/R Tubes 6½in. Diam.: Green/Blue Screen. Excellent for T.V., **20/-.** Base **2/6**, carriage, packing and insurance **5/-.**

In addition we offer the following tubes at the ridiculous price of **5/-** each (preferably to callers only as packing, carriage and insurance amounts to **7/6**). Types available. **ACR1, ACR2, ACR2X, ACR8, ACR1381, ACR19.**

VCR 97 C/R Tubes. Have slight cut-off making them unsuitable for T.V. use, otherwise perfect, **10/-** each. Base **2/6**, plus **5/-** carriage, packing and insurance.

Transmitting Triode, **VT30, 7/6** each. Postage and packing, **3/6.**

UHF Oscillators, Type **RL18, 5/-** ea., **40/-** per dozen. **CV3505, HY114B, 6/6** each.

Thyratrons, Type **CV 1141, 6/6** each, **50/-** per dozen. Type **CV 22, 20/-** each. Klystrons **CV43, 30/-** each.

1-Kilowatt Pentodes. Type **861, 20/-** (callers only).

UHF Triodes. Type **7193, 1/6** each, **12/-** per dozen.

Bayonet Base (Side Contact) Output Valves, Type **EL50,** 6.3 v., **5/-** each.

Output Triodes Type **DET 5.** An excellent replacement for PX25, **10/-** each, **75/-** per dozen.

25 watt Pentodes. Type **PT 25 H.** 4 v. 400 v., **3/-** ea., **24/-** per dozen.

Miniature Valves **CV3830** (XH 1.5), **2/6** each, **20/-** per dozen.

Transmitting and Special Purpose Valves Special Offer. Types **8012, 830B, 878, 705A, 843, 1625, 1616, 4C27, 703A, EL266.** Any of the above **5/-** each.

Type **E1148, 1/6** each, **12/-** per dozen. Type **CV52, 4/6** each.

Bayonet Base (Side Contact) Low Noise H.F. Pentode. **CV1123** (EF8), (VR123), 6.3 v., **5/-** each, **36/-** per dozen.

T.R. Box. Type **CV90, 20/-** ea. T.R. Box. Type **CV115, 5/-** each. Magnetron, **CV186, 10/-** each.

ARP3 Valves. 13 v. .2A H.F. Pentodes, **3/-** each, **24/-** per dozen.

TRANSMITTING VALVES

813	£3	U19	6/6	715A	£3
1B24	£3	527A	£1	HF300	£3
3B24	£1	357A	£3	CV19	30/-
707B	£3	282A	£2	VT58A	£3
		2E22	6/6	803	15/-

SPECIAL OFFER —NOW AVAILABLE

C.R. Tubes, Type ACR13 (CV1385). A perfect replacement without alteration for the VCR97. Guaranteed free from "cut-off," price **35/-.** Send 3d. for latest valve list of hundreds of types at lowest prices.

TERMS OF BUSINESS

Postage and Packing is free for orders over £2 in value unless otherwise stated. Under this amount, please include 1/- for orders up to 10/- and 1/6 for orders over 10/- C.O.D. orders cannot be sent under 20/-.

152-153, FLEET STREET, E.C.4. *Phone: CENtral 2833*—**and at—207, EDGWARE RD., W.2.** *Phone: AMBassador 4033*

207, Edgware Road is open until 6 p.m. on Saturdays.

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD

LONG RANGE TELEVISOR KITS FOR—

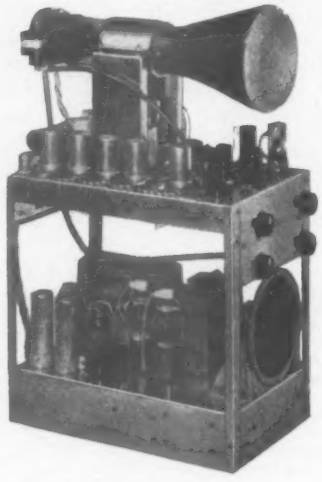
LONDON & BIRMINGHAM MODELS STILL AVAILABLE

USING VCR97 —— £17 - 17 - 0 —— INCLUDING TUBE

(CARRIAGE & PACKING 15/-)

As is usual in Premier Kits every single item down to the last Bolt and Nut is supplied.
All chassis are punched and layout diagrams and theoretical circuits are included.

FIVE EASY-TO-ASSEMBLE KITS ARE SUPPLIED :—



"ELECTROSTATIC" CONSTRUCTION BOOK 2/6

VISION RECEIVER with valves, carriage 2/6.....	£3 13 6
SOUND RECEIVER with valves, carriage 2/6.....	£2 14 6
TIME BASE with valves, carriage 2/6.....	£2 7 6
POWER SUPPLY UNIT with valves, carriage 5/-.....	£6 3 0
TUBE ASSEMBLY, carriage and packing 2/6.....	£2 18 6

This unit includes the VCR97 Tube, Tube Fittings and Socket and a 6in. P.M. Moving Coil Speaker with closed field for Television. The instruction book costs 2/6, but is credited if a Kit for the complete Televisor is purchased.

Any of these Kits may be purchased separately ; in fact, any single part can be supplied. A complete priced list of all parts will be found in the instruction book.

20 Valves are used, the coils are all wound and every part is tested. All you need to build a complete Television Receiver is a screwdriver, a pair of pliers, a soldering iron and the ability to read a theoretical diagram.

The following sensitivity figures prove that the Premier Televisor Kits are capable of reception at greater distances than any other standard commercial kit or receiver whether T.R.F. or Superhet.

VISION RECEIVER

Sensitivity	25μV. for 15V. peak to peak measured at the Anode of the Video Valve.
Sound Rejection	Better than 40 db.
Adjacent Sound Rejection ...	Midland Model. Better than 50 db.

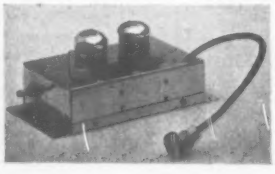
SOUND RECEIVER

Sensitivity	20μV. Vision Rejection, better than 50 db.

NEW PRE-AMPLIFIER FOR FRINGE RECEPTION AREAS

We can supply the complete kit of parts to make this wide band width Pre-Amplifier using 2-717A Pentodes. For use with Televisors able to supply 130v. 20 mA., H.T. and 6.3v., .3 amps. L.T.

Completely screened. Includes valves, chassis, diagrams, etc. **27/6**



SEPARATE POWER SUPPLY UNIT KIT IF REQUIRED.
(REQUIRED BY BOTH PREMIER KITS)

21/-

When ordering Televisor or Pre-Amplifier Kits

PLEASE STATE IF THE LONDON, BIRMINGHAM OR HOLME MOSS MODEL IS REQUIRED

CALLERS TO

207, EDGWARE RD., W.2 Phone : AMBassador 4033 (Open till 6 p.m. Saturdays)

AND **152-153, FLEET STREET, E.C.4** Phone : CENtral 2833

Terms of Business : Cash with order or C.O.D. over £1.

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

HOLME MOSS & KIRK-O-SHOTTS—NOW AVAILABLE

USING 9" OR 12" MAGNETIC C.R. TUBES

£19·19·0 *including all parts, valves and loud-speaker, but excluding C.R. TUBE*

(Carriage and Packing 15/-)

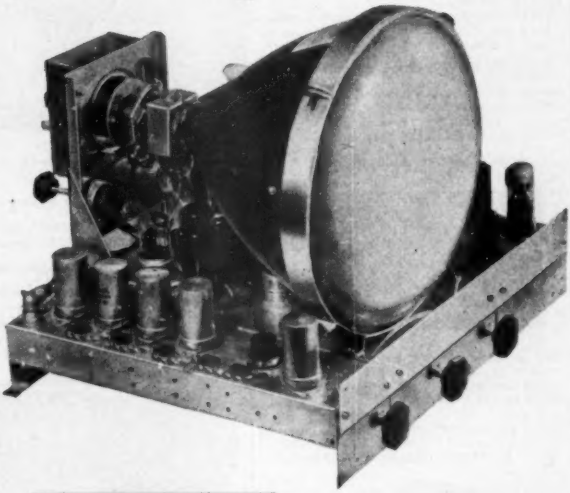
CIRCUIT DETAILS

The Vision Receiver consists of 4 R.F. stages (EF54's) which are followed by a Diode Detector and Noise Limiter (6H6) which is directly coupled to the Video valve (EF54).
Complete Kit with valves, **£3/16/0**
Carriage and packing 2/6.

The Sound Receiver comprises 3 R.F. stages (6SH7's) followed by a Double Diode Triode (6Q7) which acts as Detector and L.F. Amplifier. A Noise Limiter (EA50) is also incorporated. The output valve (6V6) drives a 10in. P.M. Moving Coil Speaker with closed field magnet, which is included in the time Base Kit.
Complete Kit with valves, **£3/1/0.**
Carriage and packing 2/6.

The Time Bases employ blocking oscillators on both Line (6SH7 and 807), and Frame (VR137) and 6V6. E.H.T. (Non-lethal) is taken from the Line Output Transformer through a voltage doubler employing two valves (VU111). The Sync separators are 6H6 and 6V6.
Permanent Magnet Focusing.
Complete Kit with valves, **£8/5/6.**
Carriage and packing 5/-.

The Power Supply is from a double-wound mains transformer completely isolating the receiver from the mains. The H.T. Rectifier is a 5U4G.
Complete Kit with valves, **£4/16/6.**
Carriage and packing 5/-.



"MAGNETIC" CONSTRUCTION BOOK 3/-

WELL MADE WALNUT FINISH
PEDESTAL CABINETS
FOR 6in. TUBE KIT £5. 10. 0
" 9in. " " £6. 15. 0
" 12in. " " £8. 8. 0
CARRIAGE & PACKING 7/6

EACH KIT OR INDIVIDUAL PART AVAILABLE SEPARATELY

PLEASE NOTE

OWING TO RAPIDLY DIMINISHING STOCKS, BOTH TELEVISOR KITS WILL ONLY BE AVAILABLE UNTIL JUNE 14th.

ALL POST ORDERS TO OUR NEW FACTORY AT
740 HIGH RD., TOTTENHAM, N.17. *TOTTENHAM 5371*
TERMS OF BUSINESS, CASH WITH ORDER, OR C.O.D. OVER £1.

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

BUILD A PROFESSIONAL LOOKING RADIO AT LESS THAN HALF TODAY'S PRICE

Two modern receiver kits are available. A three-valve, plus rectifier, T.R.F., and a four-valve plus rectifier superhet. Both are housed in attractive Bakelite Cases, size 12in. x 5in. x 6in.
Each Kit is complete in every detail, nothing has to be made or improvised. Easy to follow, point-to-point diagrams are supplied, making construction very simple. They are for use on 200-250 volt mains, and both A.C. and Universal Models can be supplied.
The Dials are illuminated, and the receivers present an attractive appearance. The increased prices are regretted but unavoidable.

T R F Valve line-up :—

EF22 H.F. Pentode.

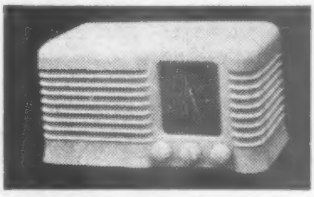
VR116 Detector.

CV1510 Beam Power Output in the A.C. model.

The A.C./D.C. Output Valve is 12A6. Both use Metal Rectifiers.

Waveband coverage is for the Medium and Long Bands.

Price £5/19/6. (Carriage and packing 2/6.) With Walnut or Ivory Cabinet.



SUPERHET Valve line-up :—

6K8, 6K7, 6Q7 and CV1510 Beam Power Output in the A.C. Model.

The A.C./D.C. Output Valve is 12A6. Both use Metal Rectifiers.

Waveband coverage is 16-50, 190-540 and 1,000-2,000 m.

Price £7/19/6. (Carriage and packing 2/6.) With Walnut or Ivory Cabinet.

WILLIAMSON AMPLIFIER KIT.

We can supply the Kit of Parts for the latest version of this famous amplifier complete in every detail for **£10/10/-**, with valves, output and mains transformers.

BATTERY CHARGER KITS.

All incorporate Metal Rectifiers. Transformers are for use on 200-250 v. 50 cycle Mains.

To charge 6 v. Accumulator at 1 amp. with resistance supplied to charge 2 v., **22/6.**

To charge 12 v. accumulator at 1 amp., **27/6.**

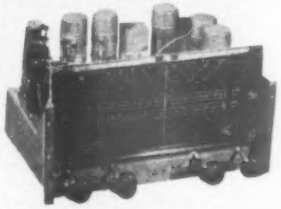
To charge 12 v. accumulator at 4 amps. with variable resistance and meter as illustrated, **75/-.**

NEW BABY ALARM KIT.

A complete Kit of Parts in plastic cabinet to construct a device to enable baby's cries or even breathing to be heard in any selected room in the house. Consists of a 2-valve amplifier (mains operated) with midget telephones which are used as microphone and loudspeaker. May be left permanently connected. Complete with valves, circuit and instructions for 200-250 v. A.C. mains, **55/-.**

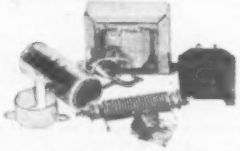
NEW A.C. ALL-WAVE SUPERHET KIT.

7 valves (plus rectifiers) for 200-250 v., 40-60 cycles A.C. mains.
4 wavebands, 13.6-52, 51-190, 190-540 and 900-2,100 metres.
Pick-up input. Uses 6K7, 6K8, 6K7, 6B8, 6J5 and two 6V6 in push-pull, giving an output of 10 watts.
Specially designed O.P. transformer to match 6V6's to 3 and 15 ohm speakers.
Negative feedback is applied over 3 stages giving a high fidelity output. Tone control is incorporated, **£14/5/-.**



Also available for A.C./D.C. mains. Specification as above except that valve line-up is 6K7, 6K8, 6K7, 6Q7, 6J7, two KT33C. In Kit form at **£13/8/10.**

H.T. ELIMINATOR AND TRICKLE CHARGER KIT.

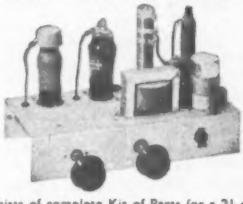


All parts to construct an eliminator to give an output of 120 volts at 20 m/a. and 2 volts to charge an accumulator. Uses metal rectifier, **35/-.**

MAINS NOISE ELIMINATOR KIT.

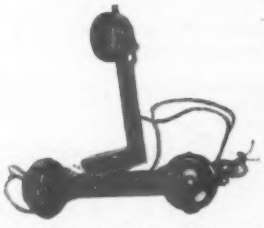
Two specially designed chokes with three smoothing condensers with circuit diagram. Cuts out all mains noise. Can be assembled inside existing receiver, **6/-** complete.

GRAMOPHONE AMPLIFIER KIT.



Consists of complete Kit of Parts for a 2½ watt Mains-operated 2-stage Amplifier for use with any type of pick-up. Volume and tone controls are incorporated. Output impedance is 3 ohms.
Cat. No. AMP147. Price complete, **59/6.**
For 200-250 v. mains with valves and diagrams.

TELEPHONE KITS.



Build yourself a 2-station telephone with two complete units as illustrated. Uses balanced armature units. No batteries needed. **15/-** Set of two Units. With diagrams.

METER KIT. A 500 MICROAMP M/C. METER, with separate High Stability, High Accuracy, Resistors to measure, 15, 60, 150 and 600 volts D.C. Scale length 1¾in., diameter 2¼in. **15/-** the complete kit.

ALL POST ORDERS TO OUR NEW FACTORY AT

740, HIGH ROAD, TOTTENHAM, N.17. Tottenham 5371

Terms of Business: Cash with Order, or C.O.D. over £1

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

MOVING COIL METERS

All 2½in. outside diameter.

50 m/a	8/6	40 amp.	7/6
20 amp.	7/6	40 v.	5/9
20 v.	5/9		

All 3½in. outside diameter.

30 m/a	10/6	500 microamps	19/6

Thermocouple meters :

3 amp.	5/-	3.5 amp.	5/-
3½in. 2 amp.	8/6		

Electrostatic ditto, 5K, 4½in. 50/-

METAL RECTIFIERS.

Bridge type :

2 v. .5 amps.	2/-	6 v. 1 amp.	4/-
12 v. 1 amp.	8/-	12 v. 4 amp.	17/6

Half wave :

260 v. 30 m/a	4/-	300 v. 75 m/a	5/-

E.H.T., Pencil Type :

Output 650 v. 1 m/a., 4/7 each.
1,000 v. 1 m/a., 6/- each.

Outputs given are half wave. Two of either Rectifiers can be used in voltage doubling.

CRYSTAL MICROPHONE.

An entirely insulated crystal microphone which can be safely used on A.C./D.C. amplifiers. High impedance. No background noise, really natural tone. The ideal Mike for tape, wire and disc recording and sound projectors. **Price 22/6.**

R.107 RECEIVERS in partly dismantled condition. A wonderful spares investment for R.107 owners, **50/-** each. Only available to callers.

POWER PACKS, input 200-250 v., 50 cycles. Output 330 v. 60 m/a, 6.3 v. 2-3 amp. and 6.3 v. .3 amps for 6 × 5 rectifier. Mounted on metal chassis approx. 6×6in., fully smoothed, **19/6** each ; 6×5 rectifier, **8/6** each.

WELDING OR GROUND HEATING TRANSFORMERS. Input 230 v. Output 15 v. 60 amps. Tapped at 14-13.5-13 v. 7½ × 7×6in. Weight approx. 50 lb. Price **55/-**. Carriage and packing, 15/-.
We have a limited number with broken terminal boards that we can offer at **35/-** plus carriage etc.

SUPER QUALITY TELEVISION MAGNIFYING LENS. To suit 5in., 6in. or 7in. tubes. Increase picture size considerably, **25/-** each.

P.M. MOVING COIL LOUDSPEAKERS

(3 ohm v/c.)

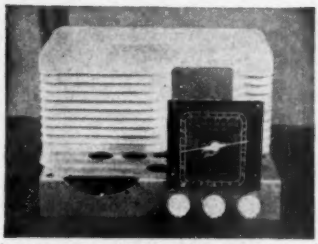
2½in. Personal Type (15 ohm v/c.)	15/-		
3½in. J.P.	9/-	8in. Plessey	14/6
5in. Rola	12/6	12in. Truvox	39/6
6in. Truvox	12/6		

5in. Speaker in handsome plastic cabinet (cream or walnut), 6×6in., with v./control, **27/6.**

MOVING COIL LOUDSPEAKERS. ROLA 6½in. ENERGISED, 1140 ohm field, with pentode O.P. Transformer, **15/-** each.

PLESSEY 5in. PERMANENT MAGNET, with extra heavy magnet and pentode O.P. Transformer, **12/6** each.

T.V. WHITE RUBBER MASKS (CORRECT ASPECT). We can supply a specially designed White Rubber Mask for 6in. C.R. tubes at **7/6** each.
9in White Masks, **9/6.** 12in. White Masks, **16/11.** Round or flat faced.



GIVE YOUR HOME-BUILT RECEIVER THAT PROFESSIONAL LOOK.

We can supply all the parts to help you.
Bakelite Cabinet (Brown or Ivory) 17/6

Punched Chassis
3 valve plus rectifier T.R.F.
or 4 valve plus rectifier, Superhet } 5/6

Engraved Glass Dials
16-50 and 180-550 metres
or 180-550 and 800-2,200 m.
or 16-50, 180-550 and 800-2,200 m. } 2/6 each

All with station names, new wavebands.

T.R.F. COILS.

180-550, 800-2,200 metres, pair 6/6

SUPERHET COILS

16-50, 180-550, 800-2,000 metres, set 10/6

CORD DRIVE ACCESSORIES FOR ABOVE.

Drum (2½in. diam.)	1/6
Driving Head	1/6
Double Pointer	4d.
Spring	3d.
Nylon Cord (yard)	6d.
Dial Back Plate	2/6

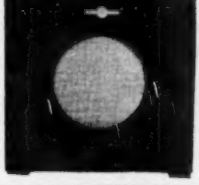
CIRCUIT DIAGRAMS

For T.R.F. or Superhet Receivers, each ... 1/6

PORTABLE L.S. CABINETS.

To take 10in. Speaker. Internal measurements 16½in. x 13½in. x 5½in. There is also a small compartment 16½in. x 5½in. x 2½in. at the top for Cables, etc.

This is an ideal Cabinet in which to construct a portable amplifier, and a chassis specially made to fit the Cabinet can be supplied if required.



CABINET 10/6
Carriage and Packing 2/6

CHASSIS to fit size 16½in. x 5½in. x 2in. deep. 6/6

THE CHANCERY LONG PLAYING ATTACHMENT G.33 *(Patents Pending)*

FOR LONG PLAYING RECORDS ON YOUR EXISTING RADIOGRAM OR RECORD PLAYER.

The Chancery G.33 is a precision engineered device of advanced design, its compactness and its simplicity of operation and fixing enabling users of normal radiogramophone and record playing equipment to enjoy the outstanding reproduction and other known advantages of long playing records.

Reduction of speed from the standard 78 r.p.m. is obtained by an epicyclic transmission and reduction mechanism, ensuring a constant speed of 33⅓ r.p.m. without rumble noise, provided that the gramophone motor with which it is employed is satisfactory. It embodies a specially designed high fidelity Decca Crystal Pick-up with a light weight balanced arm fitted with a sapphire stylus having a pressure weight of approximately 10 grammes on the record. Wear on records is thus reduced to negligible proportions, and surface scratch, so much of a nuisance in the past, is now almost completely eliminated. (It is absolutely imperative that a microgroove pick-up be used with long playing records.)

THE CHANCERY LONG PLAYING RECORD ATTACHMENT G.33 has the outward appearance of a standard gramophone turntable of the usual 10in. diameter but with a depth of ⅞in. It has merely to be placed on the existing turntable and no special fixing is required. Price complete including Decca High Fidelity Crystal Pick-up **£6/1/-.** Price less Pick-up **£3/12/6.**

3-GANG CONDENSERS. Modern bar type, .0005 mfd. ¼in. diameter spindle, ceramic insulation, **5/-** each.

EMI AUTOCHANGER.

Plays eight 10in. or 12in. Records (not mixed). Rim drive, mounted on Unit Plate 14in. square for 200-250 volt A.C. mains. Fitted with (Marconi No. 14 P.V.) high fidelity lightweight pick-up with matching Transformer. **£11/10/-**, including tax.

PLESSEY RIM-DRIVE GRAMOPHONE MOTOR, mounted on Unit Plate, with auto-stop, 10in. turntable, for 200-250 volt A.C. mains. Fitted with high fidelity magnetic Decca pick-up with sapphire stylus. **£7/15/-**, including Tax.

WRITE FOR DETAILS OF 3-SPEED GRAMOPHONE MOTORS AND RECORD CHANGERS.

BLOCK CONDENSERS. Jelly filled. 1 mfd., 1,500 v. working, **2/-** each, **18/-** per dozen ; 1 mfd., 600 v. working, **1/3** each, **12/-** per dozen ; 2 mfd., 800 v. working, **1/9** each, **17/-** per dozen.

CARBON RESISTORS

Best quality, ½ watt, 330Ω, 680Ω, 6.8K., 680K. ¼ watt, 160Ω, 190Ω, 640Ω, 6.8K.
1 watt, 22Ω, 220Ω, 390Ω, 450Ω, 1K., 3K., 3.3K., 6.2K., 15K., 24K., 40K., 44K., 68K., 75K., 1.8 meg.
2 watt, 220Ω, 270Ω, 390Ω, 750Ω, 1K., 3K., 4.3K., 22K., 47K., 3 watt, 470Ω, 91K.
All at 4d. each or **3/6** per dozen of one type or **36/-** per gross of one type.

OAK 4-PIN, 12 VOLT, NON-SYNC. VIBRATORS. 5/- each. **42/-** per dozen. Transformers for same **8/6** each. **£4** doz.

CALLERS TO:

152-153, FLEET STREET, E.C.4 and at 207, EDGWARE ROAD, W.2

Phone: CENtral 2833 *Phone: AMBassador 4033*

Terms of Business: Cash with Order or C.O.D. over £1 *207, Edgware Road is open until 6 p.m. on Saturdays*

ELPREQ PAGES

PLUGS & SOCKETS

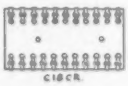
TAG STRIPS. Paxolin mounted.

Two lugs, one earthed, **3d.** each. Bin C17A.

Three lugs, centre earthed, **4d.** each. Bin C17B.

Four lugs, one end earthed, **5d.** each. Bin C17C.

Six lugs, two ends earthed, **6d.** each. Bin C17E.



GROUP PANELS. Paxolin mounted.

5 components (10 lugs), **7d.** each. Bin C18CL.

6 components (12 lugs), **8d.** each. Bin C18CC.

11 components (22 lugs), **1/-** each. Bin C18CR.

10 CORE CABLE

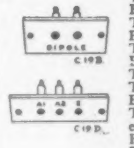
10 flexible copper conductors well insulated, suitable for mains work. Covered overall with hard rubber, **1/6** per yard.

SENSITIVE RELAY

Extra light weight only 1¼ oz., suitable for high speed work or radio control, etc. 2,000 ohm coils only require 2 mA. to operate, solid platinum contacts make or break adjustable pressure, **13/6** each.

A DUAL PURPOSE RECEIVER

With the R1155 Communications Receiver, you can either relax to the B.B.C. enjoying the same quality as with any good receiver, or when the mood suits you, you can don headphones and search out the weakest station on your favourite band. It is undoubtedly a dual purpose receiver. Its frequency range is 75 kc/s. to 18 mc/s., it uses 10 valves and is fitted in a black crackle case. Made for the R.A.F., so obviously a robust receiver which will give years of service. We have available models as delivered from Ministry, unused at **£8/19/6**, used at **£6/19/6**. We have found even the unused models owing to long storage need certain components replacing, and need re-aligning and adjustments. We have serviced some of each and can guarantee them to be in perfect working order. Price unused **£9/19/6**, used **£7/19/6**. If you cannot call to collect, please include an additional 10/- to cover cost of transit case and carriage. This is partly returnable to you if and when you return the transit case.



SOCKET STRIPS. Paxolin mounted.

Two socket engraved L.S. **6d.** each. Bin C16B.

Two socket engraved A.E. **6d.** each. Bin C18A.

Two socket engraved P.U. **6d.** each. Bin C19B.

Two socket engraved Dipole **6d.** each. Bin C19B.

Two socket plain. **5d.** each. Bin C18B.

Three socket engraved DIP and E. **9d.** each. Bin C16D.

Three socket engraved A1, A2 and E. **9d.** each. Bin C19D.

Four socket engraved A.E. Pickup, **9d.** each. Bin C19E.

Four socket engraved P.U. Ext. L.S. **9d.** each. Bin C16E.

Five socket plain. **9d.** each. Bin C16C.

3 PIN PLUG AND SOCKET

Very useful for connecting up gramophone pick-ups, extension loudspeakers, etc. We can offer this at a really knock-out price, namely **8d.** per pair.

TELEPHONE JACKS AND PLUGS

Jack Plugs, bakelite, **7d.** each. Bin D31A.

Jack Socket for D31A. **10d.** ea. Bin D31B.

Jack Plugs thin type fibre insulated. **1/3** each. Bin D31D.

Jack socket for D31D, one hole fixing for mounting on metal panels, complete with insulating and spacing washers, **1/3** each. Bin D31C.

B7G PLUG

With hard rubber body, fits into standard B7G valve holders, ideal for joining small chassis, etc., **1/4** each.

Seven way brass cased plug ideal for portable apparatus. Price **2/3** each half. Bin D33BR & D33BL.

WANDER PLUGS

Insulated split-pin type, blue **3d.** each. Bin D31F.

Insulated split-pin type, red, **3d** each. Bin D32E.

Larger banana type, black, **6d.** each. Bin D32D.

Lockable wander plug, can't fall out **9d.** each. Bin D30A.

MINIATURE FLEX CONNECTORS.

Plug and socket complete, ebonite, non-reversible. Ideal for toys, razors, etc., 2 amp rating, **9d.** pair. Bin D32B.

CO-AXIAL PLUGS AND SOCKETS.

Suitable for car radios as well as T.V. for mic. leads, etc. Plugs **6d.** each. Bin D32AR. Sockets **7d.** each. Bin D32AL.

TERMINALS. Screw and Spade.

Spades, red or black, for L.T. Batteries. **3d.** each. Bin C18E.

Spades, heavy duty, fit ex-Government car batteries. **9d.** each. Bin C20A.

Screw Earthing terminals, flat bottom plate for flush mounting, with soldering tag. **4d.** each. Bin C19C.

Earthing screw terminals, 2BA, also used for connecting two spades (as C20A) together. **9d.** each. Bin C20C.

Screw down terminal 4 B.A. with plain insulated head. **5d.** each. Bin C80F.

Screw down terminal all metal, 6 B.A., **4d.** each. Bin C21C.

SLIDLOCK FUSES

15 amp., very latest pattern for mounting on the front of instrument panels, etc. Price **1/6** each.

WE HAVE FOUND A FEW MORE

We thought we were out of stock, but while clearing one of our warehouses we came across a small quantity of that famous transmitter the T.1154. This is a medium high-powered transmitter for C.W., M.C.W. or 'phone operation. The specification is briefly as follows: The power output stage consists of a pair of PT15 pentodes driven by a ML6, a further ML6 provides grid modulation at approximately 70 per cent. Frequency coverage is 200 kc/s to 10 mc/s on three bands. These are undoubtedly first-class transmitters (they were made for the R.A.F.). Price only **£7/10/0** each, unused, complete and perfect.

TOGGLE SWITCHES

Metal body standard size, made by our leading maker. Available with round dolly or with special V cut dolly. State which type when ordering. Price while stocks last only **1/6** each.

30 AMP. ROTARY SWITCH

Double pole ON/OFF, a very robust switch, made by one of our most famous firms. Will give lifetime of service. Price complete with pointer knob, **4/9.**

METAL DIVIDERS

Really well made for Government workshops. Ideal for marking out on metal chassis. Price **3/6.**

HEADPHONES

The famous DLR2, unused and in perfect order. Price **7/6** per pair.

MORSE KEYS

Made for the army, new and in perfect condition. Price **1/3** each.

JUMBO VALVE BASES

Ceramic 4-pin for transmitting valves. Price **3/6** each.

POWER PACK FOR ALL-DRY RECEIVERS

Output 90 v. H.T. and 7.5 v. L.T. using metal rectifiers. Fitted into a bakelite case, size only 3¼ x 2¼ x 1½, complete with flex and mains input plug. Suitable for A.C. or D.C. mains. Price **19/6**.

FLEXIBLE COUPLINGS

These are sometimes known as bellows couplings because they will extend as well as bend. They are ideal for joining shafts which are out of alignment and for slug tuning controls, where the core has to come in and out. Price **1/9** each.

LESS THAN HALF PRICE

15 amp. shuttered switch plug, bakelite moulded surface, mounting type, made by very famous maker, made to B.S.S. **9/6** each.

STILL AVAILABLE—

At a non-repeatable price, the parts for a miniature tuning heart which will tune long and medium waves and which will not take up much more than 1 cubic inch of space. If you have planned to build a personal set or a tiny radio, then here is an opportunity not to be missed. For only **8/6** we supply a two-gang tuning condenser and a pair of dust-cored dual-wave coils, ultra small but nevertheless very efficient. We will also supply free of charge circuit diagrams of a battery and a mains set using these parts and further, if you care to call, we will gladly demonstrate these sets. Limited stock, so order without delay.

INFRA-RED CONVERTER CELLS

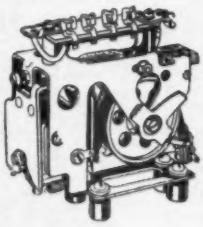
A new use for these was suggested in the March issue of this journal; we still have fair stocks, and will supply at **9/6** each or six for **52/6**. (We are told that they cost approximately £12 each to make.) We have a little data and will supply this where requested. Brief specification of the tube is that it consists of a silver caesium screen which lights up when struck by the electrons released from its cathode by infra-red rays. This cell was developed for seeing in the dark, but as it is a form of photo-electric cell, it can also be used in many of its applications, such as burglar alarms, counting, smoke detecting and other devices.

AMPLIFIER RACK

This stands approximately 6ft. high, and was made originally for the G.P.O. The top panel contains the amplifier proper, which consists of an A.C. mains-driven power pack, capable of delivering 200 mA. at 400 v. and, of course, the normal L.T. supplies, and the amplifier itself uses an MHL4 feeder and two PX25's in the output stage, giving approximately 25 watts. This top deck also contains the heavy duty output transformer. The lower panel contains the feeder unit which can be used as a pre-amplifier for microphone and gramophone work. You will observe that on the rack there is ample space for fitting a monitor speaker and an R.F. unit if same are required. Note that the anode current of the PX25 valve is monitored by a 2½in. flush meter. Further note that these amplifiers were made by the famous MARCONI company. Price complete as illustrated but less valves, unused and only very slightly storage soiled, is only **£12/10/0** each, plus carriage at cost.

— WIN £5 —

You can have a lot of fun and at the same time stand a good chance of winning either the first prize of £5 or one of the £1 consolation prizes. All you have to do is to suggest some new use for our Impulse Relay. The action of the Impulse Relay is as follows: Current to the solenoid causes the ratchet wheel to rotate 1 notch per impulse. A built-in automatic switch converts the A.C. supply into impulses and keeps the relay going until it is switched off by either or both of two independent switches, which form part of the complete relay. We can supply these Impulse Relays at **3/9** each, and we can also supply a booklet of circuits for **1/9**.



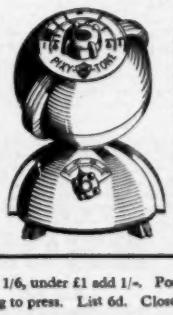
MAKING A RIBBON SPEAKER?

The January issue of this Journal showed how this could be done, making use of an ex-W.D. Magnetron Magnet. We understand the results are really first-class. In response to many requests, we have been able to secure a small quantity of American-made Magnetron Magnets. The price is **35/-** each.

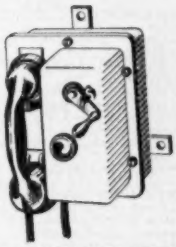
6-VOLT AMERICAN HEAVY-DUTY BATTERIES

Made by one or other of the most famous American battery companies. For reliability and long service between charges these are in a class of their own. Capacity rating is 140 amp-hour. We have a limited quantity of these batteries available, unused—in fact they have never been filled with acid, and the price is **£5/10/0**, carriage extra at cost depending upon your locality.

THIS MONTH'S SNIP



Novelty radio in coloured plastic cabinet, only 6in. high, ideal for a nursery or bedroom, complete with built-in moving coil speaker, 2-gang tuning condenser, volume control and ON/OFF switch, all wired up ready to operate as soon as valves are fitted. Works off dry batteries or through our **19/6** power units. Valves required are three of type 1T4 and one of 3V4 or 3S4. Because of a frustrated export order, we are able to offer these sets brand new and perfect, complete except for valves, at the remarkable price of **49/6** each, postage and insurance 2/6 extra. Don't delay—send your order to-day.



EX-ROYAL NAVY SOUND POWERED TELEPHONE

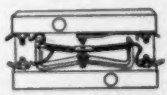
These require no batteries, and will go for long periods without attention. Complete with generator and sounder which gives a high pitched note, easily heard above any other noise. Also fitted with an indicator lamp which in quiet situations can be used instead of the sounder, or where several 'phones are used together, will indicate which one is being called. Size 7¾in. x 9in. x 7¼in., wall mounting, designed for ships' use, but equally suitable for home, office, warehouse, factory, garage, etc. Price **37/6** each, plus **3/6** carriage.

PYREX AERIAL INSULATORS

Ideal for aerial connections through cabin walls or through panels. Consists of glass dome with threaded rod and terminal ends, and metal fixing flange. Price **2/-** each.

SHEET PAXOLIN

Invaluable for when you are experimenting. Size 6in. x 6in., **1/-**. Size 12in. x 8in., **2/-**. Size 12in. x 12in., **3/6**. Size 24in. x 12in., **6/-**. Average thickness, 1/16in.



REPLACING THE U.U.8.

You can overcome the shortage of high current indirectly heated rectifiers by using a Thermal Delay Switch. You simply connect this across the heaters of a directly heated rectifier such as FW 4/500 and the H.T. will not be switched on until after the other valves have had ample time to warm up. The delay switch is as illustrated, with the addition of a protective cover. Price **3/9** each, the heater voltage is 4, but of course this can be used on higher voltages with a limiting resistant.

Orders under £2 add 1/6, under £1 add 1/-. Postable items can be sent C.O.D., additional charge approx. 1/-. Good stock of all items at time of going to press. List 6d. Closed Wed. Aft.—Open All Day Sat. **Telephone: Ruislip 5780**

ELECTRONIC PRECISION EQUIPMENT (2) ELECTRON HOUSE, Windmill Hill, RUISLIP MANOR, MIDDX.

GARLAND BROS

HIGH-CAPACITY PRECISION MICA CONDENSERS : By leading manufacturers. Accuracy plus or minus 0.5 (point five) per cent of stated value. Pure mica and copper foil.
(b) 0.023570 μF ... 1/3 (b1) 0.027400 μF... 1/6 (c) 0.035020 μF ... 1/6
(d) 0.040710 μF ... 1/6 (e) 0.055820 μF ... 1/6 (f) 0.065350 μF ... 1/6
(fl) 0.082910 μF ... 1/6 (g) 0.087460 μF ... 1/6 (h) 0.108435 μF... 1/9
(i) 0.123750 μF ... 1/9 (j) 0.147000 μF ... 1/9 (k) 0.205276 μF ... 2/-
Many close tolerance standard values may be made up by parallel or other combination of above, e.g. : 4k + i + e = 1 μF ; 2k + g = 0.5 μF; c + f = 0.1 μF. (A table of over 150 series and parallel combinations of these condensers, invaluable in calculating filter networks etc., is available on receipt of 2½d. stamp.)

CONNECTING BLOCKS. Heavy construction, 20 way with 2 B.A. set screws. 7/8in. x 1in. x 3/4in., 2/6 each.

CONDENSERS (pFs). 2, 4, 10, 15, 20, 25, 50, 75, 100, 160, 200, 6d. each, 5/6 per doz. 300, 330, 500, 1,000, 5,000, 9d. each, 7/6 per doz.

VISUAL INDICATOR TYPE 3 (10Q/4). Containing two moving-coil movements, one 0-300 μA linear, and the other a sensitive centre zero movement ideal for use as null-indicator in bridges etc. 3/- each.

PULLIN MOTORS. Type A/3R. For 24v. D.C. 3½in. x 2¾in x 2in. 8/6 each.

METAL CUTTING SHEARS. A robust tool, one-inch blades, will cut up to 16 s.w.g. aluminium. Per pair, 2/- ; per doz. pairs, 21/-.

MOVING-COIL MICROPHONES. By Lustraphone. Standard thread fitting. A blocked export order enables us to offer these at £3/15/- each.

JUNEERO ENGRAVING TOOL. For operation on A.C. 200-240v. Engraves metals or plastics. Complete pre-shaped and punched kit, with drawings and instructions, requiring only screwdriver for assembly. Invaluable in workshop. Each 8/6.

STABILIVOLT TYPE VS60. Similar to STV280/40. Operating voltages 280, 210, 140, 70v. Max. electrode current 60 mA. A further large purchase enables us to offer these at 7/6 each, or 78/- per doz. while stocks last.

UNIT OFFER. Ex-Govt. Indicator Unit Type 6A. For T/V or "W.W." oscilloscope. Containing VCR97, 4 x EF50, 3 x EB34, 10 w/w pots, 2 carbon pots, 4-pole 3-way and other switches, condensers, resistors, etc., etc. Brand-new in original transit cases. Our price £3/12/6 carriage forward.

DECCA TWO-SPEED GRAM MOTORS : For 33⅓ and 78 r.p.m. records. Delivery from stock. Price (incl. P.T.) £5/19/10.

DECCA TURNOVER PICKUP : A crystal pickup with turnover head for use with above or other two-speed motors. Delivery from stock. Price (including P.T.) £3/19/4.

SPEAKER CABINETS : 17in. x 17in. x 6½in o.d., 16½in. x 13½in. x 5½in. i.d., to take 10in. speaker. With carrying handle and separate cable compartment at top. Soundly constructed in wood, these are ideal for dance band use. 10/6 each, carriage and packing 2/6.

P.O. RACKS : 5ft. 6in. high by 19in. wide. Available again, but early ordering essential, as stocks are limited. 20/- each, collect or carriage forward. (Carriage is normally between 3/- and 5/-.)

VALVEHOLDER OFFER : C-F International Octal Valveholders in moulded black bakelite with plated contacts, 4/6 per doz., 48/- per gross, £14 per thousand.

"VIEWMASTER" AND "ELECTRONIC" TELEVISORS : All components in stock. Please see previous issues this journal for prices.

OSMOR "Q" COILPACKS : A selective high-Q coilpack of miniature size (1¾in. x 3¼in. x 2¼in.), with easy one-hole fixing. Type HO, Long, Medium and Short, 36/- plus 7/11 P.T. Type LM, Long, Medium and Gram, 28/- plus 6/4 P.T. Type T8 Medium, Long and Shipping, 35/- plus 7/10 P.T. Type EX, Medium, Short and Short, 35/- plus 7/10 P.T. Type B, Long, Medium and Short Battery with frame aerial, 37/6 plus 8/4 P.T. Type TRF Long, Medium for T.R.F. Receivers, 30/- plus 6/8 P.T.

"OSMOR" MF STAGES : Designed for use with above coilpacks. For HO, T8 and EX Coilpacks, 15/-, plus 3/4 P.T. For LM Coilpack, 13/-, plus 2/10 P.T.

OSMOR GLASS DIAL ASSEMBLY : 3-colour 3-wave, 7in. x 7in., with drive mechanism, 24/6.

T.R.F. COILS : M. and L. wave with reaction winding. Per pair, 6/6.

TELEVISION LENSES : for 9in. tube, 50/-, with filter, 55/-. For 12in. Tube, 70/- ; with filter, 75/-.

HEATER TRANSFORMERS : Pri. 230 v., Sec. 6.3 v. 1.5 A., 6/9 ; Pri. 230 v , Sec. 12 v. 1A. 7/6.

TELEVISION FILTERS : For viewing in daylight or artificial light without strain. Will fit your set without necessitating any alteration. For 9in. Tubes, 15/- each. For 12in. Tubes 18/- each.

PLUGS AND SOCKETS : Pye angle, 1/- ; Pye straight, 1/3 ; B. & L. 5-pin, 1/6 ; B. & L. 7-pin, 1/9 ; B. & L. 10-pin, 2/- ; Jones 6-way, 1/6 ; Jones 8-way, 1/9 ; Jones 10-way, 2/- ; E.H.T. Single 1/-. The above prices include plug and socket in all cases. Pye T-pieces, 6d. Pye connectors, 6d. Now in stock : Pye Angle P. & S. to fit ¼in. cable, 1/3 complete.

MOTORISED SWITCH ASSEMBLY : Type 10FB/556. Containing 24 v. miniature motor, 2¼in. x 1¼in. x 1¾in., gearing, switch contacts, etc. Ex-Govt. Motor only tested. 10/- each.

POTENTIOMETERS : Unused ex-Govt. Carbon, 3k, 10k, 20k, 50k, 100k, 200k, 500k, 1m, 2m, 3m, each 1/6. Wirewound, 5Ω, 5Ω, 50Ω, 1k, 2k, 5k, 8k, 20k, 25k, 50k, each 2/6. Special offer : Your assortment of 6 carbon and six wirewound pots as above for 15/-. 100Ω lw. pre-set pots, wirewound, 1/6 each, 15/- per doz. Humdingers, 0-10Ω 6d. each, 5/- per doz.

HARMONIC FILTER UNIT NO. 2 Type No. ZA10884, used with Wireless Set No. 36. Range 20-40 mc/s. Ideal for conversion for T.V.I suppression. Containing two wide-spaced ceramic knob-tuned 100pF variable condensers with calibrated escutcheons and pointer knobs, inductances, indicator lamp etc., in metal case with co-axial input and output. Used. Each 6/6.

WAFER SWITCHES : S.P. 3W. 1/- each ; 3P. 2W. 1/6 each; 4P. 2W. miniature 2/- each ; S.P. 10 W. 1/9 each ; S.P. 11W. 2/- each.

PUSH-SWITCHES : Type 10F/11062, G.P.O. pattern, D.P.C.O. non-locking, 1/6 each, 15/- per doz., £7 per gross.

CATHODE RAY TUBES : SCPI Electrostatic Intensifier, type C.R.T., diameter 5in., max. second anode voltage 2 kv., max. intensifier anode voltage 4 kv., medium persistence screen. Brand new in original crate or carton, 22/6 each.

CHARGER VARIABLE RESISTORS : 2.4 ohms at 6 amps. Worm-driven, 5/6 each.

AERIAL RODS : Copper plated steel. Fit into each other to make up any length aerial. Per doz. 2/- ; per gross 18/- ; per thousand £4/10/-.

TOROIDAL POTENTIOMETERS : On ceramic former. 2,400 ohms. at 50 w. Each 5/6

TX AND S.P. VALVES : CV1141 (Thyrstron), 6/6 ; VT501 (TT11), 6/6 ; RL18, 4/6 ; CV3830 (XH 1.5), 4/6 ; VU111 (4 v. 5 kv. Rect.) 4/6 ; VU133 or CV54 (4 v. 2.5 kv. Rect.), 3/6 ; CV73 (4 v. Beam Tetrode), 3/6.

MAT RESISTORS : 300 ohm 250 watt, 1/9.

ROTARY TRANSFORMERS : With permanent magnet field. Input 11/12 v., output 480 v. 40 mA. Each 10/6.

SMALL-SIZE PAPER CONDENSERS : 2μF 100 v. wkg., dimensions 1¼in. x ¾in. Ideal for cross-over networks, etc., 4/6 per doz., 45/- per gross ; £14/10/- per thousand.

AMERICAN RELAYS : 200 ohm. on two bobbins, 4-pole changeover with heavy contacts, 3/6 each.

H.F. CHOKES : 650μH, to pass 1 A., 1/3 each, 12/- per doz.

MICA T/X CONDENSERS : 500 pF, 1.5 A. at 4-7.5 Mc/s. Test 5,000 v. A.C. for ten minutes. 6 for 5/-.

MAINS TRANSFORMERS : Pri. 0-200-220-240 v. Secs. 250-0-250 v. 80 mA., 0-4-6.3 v. 4 A., 0-4-5 v. 2 A. Electrostatic screen. Tag connections. Universal mounting. Each 18/6.

MAINS TRANSFORMERS : Pri. 0-200-220-240 v. Secs. 350-0-350 v. 80 mA., 0-4-6.3 v. 4 A., 0-4-5 v. 2 A. Electrostatic screen. Tag connections Universal mounting. A truly all-purpose transformer. Each 18/6.

STABILIVOLTS : Type NSI. Voltage stabiliser and divider. Operating voltages 280 v., 210 v., 140 v., 70 v. ; max. electrode current, 80 mA. Again available. Each 10/-.

I.F. TRANSFORMERS : 465 k/c., standard size, capacity-tuned. Made for us by a leading manufacturer. Per pair 12/6.

JUNEERO TOOL AND XAKTO SLIDE GAUGE

CUTTING SHEARS FOR ROD
"XAKTO" GAUGE BAR
BENDING DIE FOR STRIP
CUTTING SHEARS FOR STRIP
FRICTIONAL TOOL SLIDE PLATE
BENDING JIG FOR ROD
PUNCH FOR STRIP AND METAL
VICE TO HOLD ROD FOR SCREW CUTTING

Bends, shears, punches and threads. For all the little jobs that waste your time. As reviewed in this journal. Tool, £1. Xakto Slide Gauge and Protractor, for use with above Juneero Tool, 7/6. Trade supplied.

ALL GOODS NEW AND UNUSED UNLESS OTHERWISE STATED. GOODS SHOWN AS EX-EQUIPMENT HAVE BEEN FULLY TESTED AND ARE IN GOOD WORKING ORDER. **PLEASE ADD POST OR CARRIAGE ON ALL ITEMS.** KINDLY PRINT NAME AND ADDRESS

We maintain a very complete and comprehensive stock of valves, cathode tubes and components for radio, television and electronics. Our shop hours are 9 a.m. to 6 p.m. on Monday, Tuesday, Wednesday, Friday and Saturday, and 9 a.m. to 1 p.m. on Thursday, during which times we are always pleased to welcome callers. Post orders to Garland Bros., Chesham House, Deptford Broadway, S.E.8.

GARLAND BROS.

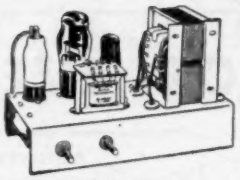
GARLAND RADIO
CHESHAM HOUSE, DEPTFORD BROADWAY, S.E.8
TELEPHONE : TIDEWAY 4412/3

ALLEN & GOULD
5, OBELISK PARADE, LEWISHAM, S.E.13
TELEPHONE : LEE GREEN 4038

HI-FI!

"EASY-TO-BUILD" KIT AMPLIFIER A1

for AC 200-250 v. only. Kit, incl. valves, for gramophone amplifier giving high quality reproduction. Simple instructions with many illustrations enable even those without previous experience to construct this amplifier. Kit complete in every detail down to solder tags and solder. Pre-drilled chassis, group board with all resistors, condensers, etc.



Complete kit with instruction manual ... £4.2.6
Instruction manual only ... 3.6
Tone control kit 5.0

AMPLIFIER TYPE A2 for AC/DC 200-250 v.

Employs same fundamental circuit as the A1. Gives first-class reproduction. Kit complete in every detail.

Complete kit with instructions	£2 19 6
Instruction manual only	3 0
Tone control kit	5 0

RADIO TUNING UNIT TYPE RFI.

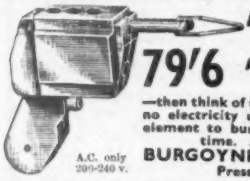
Complete Medium Wave Radio Tuning Unit for use with A1 or other AC amplifier. A "straight" TRF circuit is employed using two high gain pentodes. Reproduction is excellent. High sensitivity means it may be used in areas of moderate signal strength.

Complete kit with instructions	£2 5 0
Instruction manual only	2 0

START TO BUILD the "VIEWMASTER" FOR £5 DOWN

Exclusive H.P. Offer

Ref.	Components	Dep.	12 Payments Monthly
A	W.B. Sound, Vision and TB Chassis. Side and Tube Supports. Frame and Heater Trans. Main Choke, Speaker	£2	10/10
B	Sound, Vision and TB Chassis, Side and Tube Supports ..	£1	4/1
C	T.C.C. Condensers LONDON	£2	9/3
D	T.C.C. Condensers. MIDLAND	£2	10/-
E	Westinghouse Rectifiers	£1	3/11
F	Plessey Scanning Coil. Focus Flag. Width Control. Line transformer. Boost Choke	£2	3/8
G	LONDON. Morganite Resistors. Q Pots. Six Colvern Pots. Wearite Coils and R.F. Choke L6. Belling Connector and Switch. Bulgin Plug and Socket, Feeder	£2	5/8
H	MIDLAND. As G, but with four Wearite Filter Coils ..	£2	6/5
I	LONDON. Pre-amplifier Chassis. 5 Condensers. 5 Resistors. 2 Coils. 1 Valve and Base. With instructions	£1	2/2
J	MIDLAND. Pre-amplifier. As for I	£1	2/2
K	Conversion Kit—Table to Console. Plus Components as A ..	£2	12/9
M	9in. CRT. Mullard MW22/14C or MW22/17	£5	11/8
N	12in. CRT. Mullard MW31/14C or MW31/17	£5	13/7



A.C. only 200-240 v.

79/6 A REVOLUTION IN SOLDERING!

Are you fed-up with your old-fashioned soldering iron?

—then think of this: iron cold when not in use; no electricity used unless making a joint; no element to burn out; fractional warming-up time. All this you get with the BURGOYNE 7-Second SOLDER GUN

Press a button and solder!

MORSE OSCILLATOR

"Buzzer Valve Type 2." A morse oscillator of high quality. A five-position switch selects the desired note and a control the output level. A jack is provided for superimposing interference over the CW note.

Complete. **15/-**
Carr., pkg., 1/6 extra.

R1355 Brand New

For that inexpensive Television Receiver, Only **52/6**

"R3515"

21-valve receiver ideally suited to construction of an inexpensive television receiver. The six-stage IF amplifier is on a frequency of 14 M/c and has sufficient bandwidth to produce an excellent definition picture. The space on the chassis is such that the complete receiver can be constructed as one unit (excluding power supplies). Circuits provided. (*See article in "Short-Wave Listener," May, 1950*). BRAND NEW (in crates) Carr. Paid. **£3.10s.**

For RELIABILITY plus EFFICIENCY you must have a BURGOYNE AERIAL CONNECTOR

This is the ONE and ONLY unit available which enables a really efficient and reliable weather-proof connection to be made between dipole and feeder. Why continue to worry about your dipole? Come gale or hail, rain in drops or by the bucket, this connector will never let you down. ORDER NOW.

12/3 Plus 9d. postage.

BRAND NEW IN ORIGINAL CARTONS

"TELEROD" INDOOR TELEVISION AERIAL

The TELEROD aerial is an inexpensive and easily installed indoor television aerial. It has four distinct uses, thereby satisfying the needs of a large variety of locations, for the aerial may be installed in any of the following ways:

as an "L" type aerial.
as an "inverted-V" type aerial.
as an "inverted-T" type aerial.
as an ordinary dipole.

Each TELEROD aerial is individually boxed complete with instructions for installation, and consists of a rigid element which is stove enamelled a pleasant brown, a flexible element, and a generous length of feeder cable. (The feeder is 75-ohm coaxial cable.)

Prices which vary according to the area designated are as follows:

Area	Retail Price	
London	27/6	Plus 2/6 Postage.
Holme Moss	27/3	
Kirk O'Shotts	27/-	
Sutton Coldfield	26/9	

REMINGTON "Blue Streak" ELECTRIC DRY SHAVER

The World's finest Multiple Head Shaver.

Shave anywhere without fuss. No brush, soap or hot water needed. Even the toughest beard and tenderest skin respond to the Remington.

The FOURSOME (4 shaving heads)	£7 16 5
The FIVESOME (5 shaving heads)	£8 17 7

A 'SIX-in-ONE' KNIFE with DOZENS of USES

A first-rate pocket knife of high grade steel with 'Pearleen' handle.

Combines

- **Large, strong, sharp blade**
- **Awl (Spike)**
- **Screwdriver**
- **Bottle opener**
- **Corkscrew**
- **Tin opener**
- **Safety Ring**

This is something more than a pocket-knife: it is a miniature 'tool kit' which will come in handy a dozen times a day.

ONLY **7/6** Plus 6d. postage.

LIGHT WHERE YOU NEED IT!

—with a **FLEXIBLE TABLE LAMP**

Avoid eyestrain with good light. For reading, writing, typing, sewing, odd jobs—for fireside and bedside, the ideal lamp. Flexible stem for exact adjustment. Complete with shade, flex and switch. Green or cream — please state preference.

PRICE ONLY 45/-
plus 1/6 carriage

DECCA PLAYING DESKS.

33A. Single speed player for 33⅓ r.p.m. records Light-weight crystal pick-up with sapphire stylus in spring-balanced arm. Mounted on heavy pressed steel base. A.C. ONLY 200-250 v. **£9.9.0**

33B. Specification as per 33A. but enclosed in strong leathercloth covered wooden case with lid. **£12.1.6**

M·O·S MAIL ORDER SUPPLY CO., THE RADIO CENTRE, 33 Tottenham Court Rd., London, W.1. Museum 6667

SOMETHING FOR EVERYONE

COMMUNICATIONS RECEIVER R.1155

Another purchase from the Ministry of Supply enables us to once again offer this superlative communications receiver at "give away" prices. A World Station Getter, this 10-valve set covers 5 wave ranges : 18.5-7.5 mc/s., 7.5-3.0 mc/s., 1,500-600 kc/s., 500-200 kc/s., 200-75 kc/s., and is easily adapted for normal mains use, full details being supplied. NEW, IN MAKER'S CASES AND AERIAL TESTED. **£9/15/-.** (Carriage 10/- extra.)

RECEIVER A.E.W.1

A 5-valve superhet covering 550-1600 kc/s. and 6-12 mc/s. in 4 switched wavebands. Operates from 6 v. D.C. source through built-in vibrator pack, and has large separate speaker in metal cabinet with 50ft. extension lead. Made for New Zealand Forces Welfare Dept., these sets have 2.5 watts output and are NEW and UNUSED. Valve line up : 6U7 R.F. Amp., 6K8 Mixer, 6U7 I.F. Amp., 6Q7 2nd detector, 1st Audio, 6V6 Output. The set is fitted with a large open slow-motion tuning dial, size 7in. x 3in. and both set and speaker are finished in olive green crackle. An ideal receiver for caravans, coaches, country areas, etc. ONLY **£9/19/6** (Carriage etc., 10/6).

BATTERY SUPERSEDER. With restrictions on the use of zinc those H.T. batteries are likely to be scarcer. Fit a superseder and forget. Operates from a 2v. accumulator and delivers 67 volts at 4.7 ma., 130 volts at 13-25 ma., also 1.4 v. L.T. Originally designed for use with Canadian Walkie Talkie equipment this American made unit can be easily adapted for use on any set, and full, illustrated details are supplied. ONLY **69/-** (postage 1/6), or with two 2-volt accumulators in metal case, **90/-** (carriage, etc., 5/-).

TELESCOPIC AERIALS, extending from 15in. to 102in. Just pulls out of steel tube. Very strong. BRAND NEW. ONLY **12/6** (postage 10d.).

HEADPHONE AND MICROPHONE SET. A pair of 4,000 ohms phones fitted with rubber noise excluders, and a high grade carbon microphone. BRAND NEW ONLY **12/6** (postage 10d.).

RECEIVER 3547. Contains the "Pye" 45 mc/s. I.F. strip, which is easily removable, and 15 valves : EF50, 3 EB34, 2 SP61, and 1 each EA50, EBC33, EF36. BRAND NEW IN MAKER'S CASES. ONLY **120/-.**

MINIATURE DYNAMOTOR UNIT. D.C. input 28 volts at 1.1 amps. D.C. output 250 volts at .06 amps BRAND NEW. ONLY **12/6** (postage 1/-).

AMERICAN LORAN RECEIVER APN4. Contains 16 valves : 3 6B4, 2 2X2, 4 6SK7, and 1 each 5U4G, 6H6, 6SU7, 6SL7, 6SN7, VR105. Covers approx. 550-650 metres in 4 switched bands. ONLY **69/6** (carriage, etc., 5/-).

MAKING AN OSCILLOSCOPE ?

Then you want the **INDICATOR UNIT TYPE 6,** as recommended for the "Wireless World General Purpose Oscilloscope." Fitted with 6in. C.R. Tube type VCR97, 4 valves EF50 and 3 of EB34. Another purchase from the Ministry of Supply enables us to offer these units, which are BRAND NEW IN MAKER'S CRATES at ONLY **79/6** (carriage 7/6). Constructional data as above supplied free with each unit, or available **9d.**

The following component parts are in stock :

EHT Transformer for VCR 97 tube. ONLY **32/6** (postage 1/6).

4v EHT Rectifier, with ceramic base. ONLY **8/6** (post 9d.).

CHOKES 20 h. 80 ma. ONLY **6/6** (post **9d.**).

AIRCRAFT CLOCKS

8 day movement and really precision made. Have mounting flange, and are ideal for Car, Boat, Workshop, etc. BRAND NEW. ONLY **50/-** (postage etc., 2/6).

10 VALVE 1½ METRE SUPERHET ZC8931. THE receiver for really long distance results. Valve line up is 6 of VR65, 2 of VR92, and 1 each VR136 and VR137, and the 12 mcs. 6 stage I.F. strip gives tremendous amplification with ample bandwidth of 4 mcs. Easily modified, full details covering both stations supplied. BRAND NEW IN MAKER'S CARTONS. ONLY **59/6** (Carriage 5/-).

I.F. STRIP, TYPE 194. An easily modified I.F. Strip recommended for constructors who want good results at moderate cost, or for those who have built televisors but are having trouble in the vision or sound receivers. This 6 stage strip measures 18in. x 5in. x 5in., and contains 6 valves VR65, and 1 each VR53 and VR92. Full details of modifications for both stations are supplied. BRAND NEW. ONLY **45/-** (Postage, etc., 2/6).

"PYE" 45 MCS. I.F. STRIP. Ready made for London vision channel, this 5 stage strip contains 6 valves EF50 and 1 EA50. Circuits and mod. data supplied. BRAND NEW. ONLY **60/-** (Postage etc, 2/6). Less valves **39/6** (Plus 2/6 postage etc.).

INDICATOR UNIT TYPE 62. Contains VCR 97 tube, 16 valves VR65, 2 VR54, 2 VR92, and shoals of condensers, resistors, potentiometers, etc., etc. The last few to clear at ONLY **59/6** (carriage, etc., 12/6).

Also available are some chassis only of this indicator (no valves or tube) and they are a really "Happy hunting ground" for components, of which there are hundreds of condensers, resistors, potentiometers, etc. ONLY **17/6** (Carriage 5/-).

INDICATOR UNIT TYPE 184A. Contains two C.R. Tubes, 3 6in. VCR 517 and a 3in. VCR 139, 5 valves type EF50, 3 type EB34, 3 type SP61, and 5 diodes EA50. ONLY **75/-** (Carriage etc. 12/6).

RECEIVER TYPE 139. Contains 4 valves, 1 each EF50, SP61, EA50, CV66, and a small impulse motor. ONLY **11/6** (Postage 1/-).

COMMAND RECEIVER FOR 100-200 METRES. A 6 valve superhet containing all metal valves, 3 of 12SK7, 1 of 12K8, 1 of 12SR7, 1 of 12A6. I.F.s 1415 kc/s. Ideal for Trawler Bands etc. BRAND NEW, ONLY **59/6,** carriage paid.

PACKARD BELL PRE-AMPLIFIERS. A first class American job designed to increase the output of low gain microphones and pick-ups. Most efficient. Contains two double valves, push pull input, and push pull output transformers, a relay, a choke, etc., etc. BRAND NEW IN MAKER'S CARTONS. ONLY **14/6** (Postage 1/3) or with 2 spare valves **22/6** (Postage 1/3).

INSULATION TESTERS (MEGGERS). Manufactured by Record. Readings up to 20 megs. at 500 v. pressure. A FEW ONLY AVAILABLE AT **£8/10/-,** carriage paid.

RECEIVER R.1355

as specified for "Inexpensive Television." Complete with 8 valves VR65 and 1 each 5U4G, VU120, VR92, also a copy of "Inexpensive TV." ONLY **55/-** (Carriage, etc., 7/6).

3½in. PANEL METERS. The following meters are all Moving Coil, have 2½in. scales, and are Flush Mounting.

0-1 ma., with 50 division scale; 0-100 ma., with 50 division scale; 0-500 ma., with 50 division scale. FOUNDATION METER scaled OHMS, MILLS and VOLTS. Ideal for making a test meter. ALL BRAND NEW IN MAKER'S CARTONS. ONLY **15/-** each (Postage, etc., 1/-).

Cash with order please, and print name and address clearly

U.E.I. CORPORATION

Radio Corner, 138 Gray's Inn Road, London, W.C.1. *Phone:* TERMINUS 7937

(Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross)

UNIVERSITY RADIO

Offer Guaranteed Used Equipment at Attractive Prices

One only, Non Auto Change Decca Deccalion, in perfect condition and working order, As new £20 0 0

B.S.R. Ampligram, model AG.4, Perfect £21 0 0

Hambander, as new £13 0 0

MCR.I. Complete with coils, power pack, phones, etc., as new £8 0 0

Evershеds, 500 volt Wee Megger, in leather case, as new £9 10 0

B.P.L. Signal Generator, A.C. 200/250 volts, As new £11 0 0

Sound Sales 1949, P.M. As new £5 0 0

Hallicrafters, SX16 ..... £21 0 0

Fosters Transformers, 230/240, VI phase, Sec. 12 v. 60 amps. Perfect £3 10 0

Goodmans 12in. P.M. Speaker, As new £4 10 0

BC.348, complete with valves, converted for A.C. 200/250 mains. As new £17 10 0

Universal Avo Minor. As new £7 0 0

Eddystone 640 Communication Receiver, complete with valves perfect and as new £21 0 0

Hunts Resistance Capacity Bridge Model CRB. Perfect and as new £10 10 0

Taylor Circuit Analyser Model 20A, Perfect and as new £11 10 0

Avo Meter Model 40, As new ... £12 10 0

M.C.R.I. Complete with power pack and all coils. Perfect £8 0 0

Avo Model 7. As new £14 10 0

Avo Model 7, with Avo leather case as new £16 0 0

Taylor Universal Test Meter, Model 75a, As new £9 10 0

Phillips Communication Receiver, P.C.R.I. As new, with A.C. powerpack and perfect condition £13 0 0

Rola G.12. Energised Field 2,000 ohms, 15 ohm speech coil £3 0 0

Wilkins & Wright, coil M/C. pick up with equaliser, As new £5 0 0

Barker 148A. As new £10 0 0

Enerst Tuner Fluxmeter. As new. Complete £18 10 0

Valradio Convertor, 200/250 v. DC/200/50AC, 300 watts, 75 cycle, works overhauled. As new £11 0 0

Mieco 30 watt Amplifier, M/coil Mike and Gram inputs, Variable output impedance, AC 200/50, As new £16 10 0

Latest Model Avo Wide Range Signal Generator. As new ... £21 0 0

WE NEED GOOD USED EQUIPMENT URGENTLY
PLEASE SEND, BRING OR PHONE FOR OFFER

E.D.C. Rotary Converter, 230 D.C. to 230 A.C., 200 watts, with filter unit and silencing cabinet. Perfect £15 0 0

Vitavox 12in. P.M. Speaker, As new £4 10 0

Avo 1948 Model Signal Generator, As new £11 11 0

Avo Valve Testers. 1948/49, with Roller Panel. As new £12 0 0

1948 Model Collaro Microgram, Complete and in perfect condition in portable case £12 0 0

Collaro 1950 model Auto Change Microgram. As new... £20 0 0

Garrard RC65, Mixer Changer, Centre drive, A.C. 110/250 volt. £15 0 0

Collaro Centre Drive A.C. Gram Motors with turntables £4 10 0

Advance Signal Generator, Model E.1. As new £16 0 0

G.E.C. Miniscope. Complete and perfect. As new £15 10 0

Simon Sound Service Recording Amplifier, Model EA.25, complete £17 10 0

Hallicrafters, S.27, in new condition complete with valves ... £30 0 0

Taylor AC/DC Junior Test Meter. As new £6 0 0

Wharfedale, W.10 CS Speaker, As new £5 0 0

Wharfedale, 10 in. Golden Speaker, As new £3 0 0

Parmeko, 12 volt D.C. 10 watt, Mobile Amplifier, with hand mike, complete and perfect ... £10 10 0

Taylor Valve Tester, and meter combined model 47AP. As new £18 10 0

Taylor Meter Model 85a. As new £13 0 0

Avo All Wave Signal Generator Mains operation in new condition £11 10 0

Taylor Signal Generator Model 65B. As new £10 10 0

Romac 25 watt A.C. Amplifier, with built-in radio, gram unit and M/C. mike, inputs. As new £24 0 0

Triplett, U.S.A. Valve Tester, in portable case, complete with charts. As new £14 0 0

Taylor 55A Valve Tester, as new £14 0 0

Hickock, U.S.A. Valve Tester, in portable case. As new with all charts and complete £14 10 0

Ex W.D. Stab volt type 8, Stabilised Voltage Power Pack, in perfect condition and working order £18 10 0

Ex W.D. Avo Model, AC/DC, as Model 40, perfect £9 10 0

Radiometer Valve Tester, perfect, with charts £6 0 0

Westalite Charger, 48 cells at 2 amps A.C. 200/250 volts. As new £11 10 0

Eddystone 358X, with 9 coils and A.C. Power Pack, 100 kc/s. to 30 meg. In perfect condition ... £20 0 0

Brierley Ribbon Pick up, with equaliser, As new £8 0 0

Brierley Armature Pick-up, with equaliser. As new..... £7 0 0

Taylor Resistance Capacity Bridge, As new £8 0 0

Collaro RC49 Mixer Changer Autos, A.C. As new £15 8 0

Transmitter R.1154, in perfect condition £7 10 0

Valradio Convertor, 50 cycle works overhauled, 200/50DC/200/50AC, 300 watts £11 0 0

R.C.A. 50 watt Amplifier, chassis and valves with output Transformer AC 100/250. Perfect condition £10 10 0

Ardente 6 watt AC/DC Amplifiers, M/coil Mike and gram inputs, as new and in perfect condition ..... each £7 0 0

WE HAVE A LARGE RANGE OF AC/DC AMPLIFIERS. WRITE STATING YOUR REQUIREMENTS.

AR88D, fitted in Walnut Floor Console cabinet with valves and speaker, AC 200/250 volts. Perfect £40 0 0

C.D.P. Disc Recorder, less amplifier, as new and complete £27 10 0

Ex W.D. Mine Detectors, less batteries, in touring case £7 10 0

Connoisseur Motor and Decca Pick up, L.P. As new £14 0 0

Pullin Series 100 AC/DC Test Meter. As new £8 10 0

Weston AC/DC Test Meter, E.772. 20,000 opv. As new £18 10 0

Weston AC/DC Test Meter, E.772. 1,000 opv. As new ... £13 0 0

Rees Mace AC/DC 110/250 volt, 6 valve Radio, 30 meg. to 550 kcs As new. Perfect £15 0 0

12 Volt Adaptor for Pam Amplifier. As new £9 10 0

Decca L.P. Record Player, in portable case. As new £8 0 0

B.S.R. L.C(1.50A Audio Oscillator As new £32 0 0

THESE ITEMS ARE ONLY A SMALL SELECTION FROM OUR STOCK OF EQUIPMENT. YOUR ENQUIRIES FOR ANYTHING THAT YOU MAY NEED WILL BE WELCOME **WE HAVE OTHER EQUIPMENT ARRIVING DAILY!**

CASH OR CHEQUE WITH ORDERS. ALL ITEMS LISTED ARE CARRIAGE PAID UP TO 50 MILES

22 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2

Phone: GERrard 4447 and 8582. Hours 9 to 6. Thursdays 9 to 1

The Latest W.B. "Stentorian" P.M. Speakers. 2½in. **15/6**; 3½in. **16/6**; 5in. **17/6**; 6in. **21/-**; 7in. **21/-**; 8in. **24/-**; 9in. **26/6**; 10in. **37/6**.

Potentiometers. New Centralab: 2K, 5K, 10K, 25K, 50K, 100K, ½, 1 and 2 meg., less switch, **3/9**, with switch, **6/-**. Midget with switch, ½, ¼ and 1 meg., **6/-**. Surplus Midget, 1in. dia. valves between 6 ohms and 2 meg., **2/6** each.

Surplus Potentiometers. All standard size with extended spindles: 5K, 10K, 15K, 20K, 25K, 50K, 100K, 250K, 500K, 750K, 1 meg., **2/-** each.

Coils. Denco Maxi "Q" High "Q" with miniature size Litz wound on Polystyrene Formers with adjustable Iron Dust Cores. Aerial, H.F., or Oscillator for 465 k.c. or 1.6 m/c. Range covers all wavebands from 3.6 to 2,000 metres. Wiring diagram. **Prices:** Chassis Mounting **3/9** (with React. **4/9**). Octal fitting pin base, **4/-** (with React, **5/-**). **Denco** T.R.F. Matched pair Medium and Long Waves, **6/6** pair. Weymouth T.R.F. Matched pair M. and L. Waves, **9/6** pair. Superhet Matched pair S.M. and L. Waves, **8/9** or **11/6** pair. All types Wearite "P" Coils, **3/-** each in stock. Weymouth Midget 1½in. × ¾in. dia., Iron Core, Aerial, H.F. or Osc., **3/6** each.

Electrolytic Condensers. B.E.C. Midget Can Tubular, 8 mfd. 450 v. (1¾in. × ¾in. dia.), **2/6**; 8-8 mfd. 450 v. (1¾in. × 1in. dia.), **4/-**; 16-8 mfd. 450 v. (1¾in. × 1in. dia.), **4/6**; 32 mfd. 450 v., **5/-**; 16-16 mfd. 450 v. (1¾in. × 1¼in. dia.), **4/6**; Dubilier "Driflic" Card Tubular, 4 mfd. 500 v., **3/6**; 8 mfd. 500 v., **4/-**; 16 mfd. 500 v., **5/6**; B.I. Can, standard size, 8 mfd. 500 v., **3/9**; 8-8 mfd. 500 v., **5/-**; 16 mfd. 500 v., **4/3**; 16-16 mfd. 500 v., **5/3**; 32 mfd. 500 v., **5/-**; All New Stock. Dubilier mica .001 mfd. 5,000 v., **2/6**.

Denco I.F. Liner for accurately lining-up 465 kc/s., or 1.6 m/c. I.F. channels. Pre-tuned circuits, battery operated and completely self-contained. Price **42/-** (incl. P.T.).

Coil Packs. Osmor Midget Coil Pack. Size 3¼in. × 2¼in. × 1¼in. covering S. M. and L. Waves. Coils wound on Polystyrene Formers with adjustable Iron Cores, ensures efficient performance. Factory wired and aligned. Price, including full circuits for Superhet 465 kc/. Unit **23/-**. Plus 7/4 P.T. This Osmor Coil Pack is also available for Midget Superhet **BATTERY** Portable sets, including a matched ready wound Frame Aerial. Price **37/6** (plus 8/10 P.T.). **Weymouth** Midget 3¼ × 2¼in. × 1¼in. covering S.M.L. W/Bands, for 465 k/c., employing Matched Iron Cored Coils on each W/Band, **42/10**. **Wearite** Superhet Type 705 and 706, size 4¼in. × 3¼in. × 1¼in., covering two Short Wave and one Medium W/Band or S-M-L Wavebands 465 k/c., employs Iron Cored Coils. **37/10**. All of the above Coil Packs include Switching, Padding and Trimmer Condensers.

You're SURE to get it at

STERN'S

ESTABLISHED 25 YEARS

Output Transformer Stern's. Midget 1¼in. × 2in. × 1in. ratio 60-1, **3/9** (or ratio 90-1, **3/9**). Stern's Multi-ratio (over 12 ratios, some C.T.), 8/6 watts, **8/6**. Stern's Heavy Duty Multi-ratio, all C.T.apped, handles 13 watts and suits P.X.4s, 6L6s, etc., **29/6**. Rola Multi-ratio, 3/6 watts, **13/-**.

L.F. Chokes. Midget 10 henry 250 ohm 40 m.a., **3/6**; 20 hny. 250 ohm 60 m/a., **6/6**; 20 hny. 300 ohm, 100 m/a., **11/9**; 5 hny. 50 ohm 250 m/a., **38/6**; 30 hny. 250 ohm 120 m/a., **28/-**; 9 hny. 250 ohm, 120 m.a., **8/6**.

Metal Chassis. Substantially made of gauge 16 S.W.G. with four sides. 7in. × 4in. × 2in., **2/3**; 9in. × 5in. × 2½in., **4/3**; 10in. × 6in. × 2½in., **4/11**; 10in. × 8in. × 2½in., **5/6**; 12in. × 9in. × 2½in., **6/8**; 14in. × 9in. × 2½in., **6/11**; 16in. × 8in. × 2½in., **7/3**; 16in. × 8in. × 3½in., **8/6**.

I.F. Transformer, 465 k/c. New well-known manufacturer's surplus 2in. × 2in. × 1¼in. Iron Core, **9/-** each. Denco Iron Core, 465 k/c. or 1.6 m/c., 1¼in. × 1¼in. × 3½in., **16/6** pair. Wearite Stand Cap, Tuned, 465 k/c., **20/-** pr. New Surplus 465 k/c. Iron Core, 4in. × 1¼in. sq., **10/-** pair.

Meter Rectifiers. Westinghouse 250 micro/amp., **11/6**; 1 m/a., **10/6**; 5 m/a., **6/6**.

Selenium Rectifiers. H.T.H. wave. 250 v. 50 m/a., **5/6**; 250 v. 100 m/a., **7/6**; 250 v. 170 m/a., **13/9**.

F. Wave Bridge Rectifiers for Battery Charging or Models 2, 4 or 6 v., 1½ amp., **8/6**; 6 or 12 v. 1½ amp., **11/9**; 6 or 12 v. 3 amps., **21/-**; 6 or 12 v. 6 amps., **25/-**; 12 or 24 v. 3 amps., **23/6**.

Variable Resistor to control charging (or model speed) up to 3 amps. rating, **13/6**. Suitable METER, **5/9**.

Charger Transformers. Suitable for use with preceding Rectifiers. Each has input of 230 volts. Outputs (a) 24 volts tapped 15 v., 9 v. and 4 v. at 3 amps., **22/9**; (b) 30 volts tapped 15 v. and 9 v. at 3 amps., **23/9**; (c) 15 volts tapped 9 v. at 3 amps., **16/6**; (d) 12 volts, 1½ amps., **11/8**; (e) 15 volts tapped 9 v. at 6 amps., **21/6**; 15 volts tapped 9 v. at 1½ amps., **13/6**. 12 volts 1 amp., **7/6**.
A Battery Charger Wiring Diagram is included with purchase of Charger Transformer and Rectifier.

NEW SURPLUS!! FOSTER TRANSFORMERS. PRIMARY 230 VOLTS. SECONDARY 12 VOLTS 9 AMPS. 21/-.

Fitament Transformer. Inputs 230 volts, outputs 6.3 v. 1½ amp., **3/3**; 4 v. 1½ amp., **7/6**; Input 200/250 v., output 4 v. (C.T.), 1½ amp., 4 v. 2 amp., 6.3 v. 2 amp., **19/6**. Input 230 v., output 6.3 v. (C.T.) 4 amp., **16/6**.

Westinghouse Rectifiers. (a) H.T.31. Rated 350-0-350 volts, 100 m.a., **35/-**; (b) H.T.32. Rated 350-0-350 v., 200 m/a., **37/6**; (c) H.T.33. Rated 300-0-300 v., 200 m/a., **50/-**; (d) Type 16H.T.56, **17/9**; (e) Type 36E.H.T.95, **11/9**; (f) Type 36E.H.T.75, **Rated** 2.5 kV., 1 m.a., **17/6**; (g) Type 36E.H.T.100. Pulse rating 5/6 kV., **26/8**.

Mains Transformers. All New Stock with Primaries tapped for 200-250 volts. Secondaries (a) 250-0-250 volt, 80 m/a., 6.3 v. (tapped 4 v.) 4 amp. and 5 v. (tapped 4 v.) 2 amp., **18/6** (also available with 350-0-350 volt at **19/6**). Stern's 350-0-350 volt, 150 m.a., 6.3 v. (tapped 4 v.) 4 amp. and 4 v. (tapped 4 v.) 2 amp., **41/6**; (c) 350-0-350 v. 250 m/a., 4 volt, 8 amp., 4 v. 3 amp. 6.3 v. (tapped 2 v.) 2 amp. and 6.3 v. 6 amp., **72/6**, and many to other ratings.

Heater Auto Transformers: (a) tapped 2 v. 4 v., 5 v., and 6.3 volts 3 amp., **9/6**; (b) 4 v. 3 amp. to 5 v. 2 amp. Reversible, **6/6**; (c) 4 v. 3 amp. to 6.3 v. 2 amp. Reversible, **6/6**.

Power Potentiometers. Bulgin adjustable slider type, max. 6 ohms 60 watt, or 14 ohms 60 watt, **13/6** each. Ex-Govt. Rotary Adjustable 50 ohms 60 watt, **5/9**.

A 4-Station Pre-Set Tuner. For Superhet circuits 465 k/c. A complete self-contained unit from which any 3 Medium W/band and 1 Long W/band Stations may be pre-selected, and then individually selected by turn of Rotary Switch. No Tuning Condensers required, only 4 connections are necessary, price **40/-**.

Adjustable Mains Droppers. 1¼in. dia. × 2¾in. (a) .15 amp., 1000 ohms, **5/-**; (b) .2 amp., 1,000 ohms, **4/3**; (c) .3 amp. 600 ohms, **5/-**.

KITS OF PARTS AND CONSTRUCTORS' ASSEMBLY OUTFITS

Assembly Instructions and Circuit to build an
A.C. MAINS MIDGET 4-STATION "PRE-SET" RECEIVER
We now have available a complete set of detailed Assembly Instructions, showing Wiring Diagram, Practical Component Layout, Point-to-Point Connections, and Individual Component Price List, for the construction of a 4-STATION "PRE-SET" 4 VALVE SUPERHET RECEIVER.
This Set is designed to receive three chosen stations on Medium Waveband and one on Long Wave, each station being then selected by the turn of a Rotary Switch, no tuning being necessary. It is of Midget size, being 8½in. × 4in. × 7in. high, when fully assembled, and can be completely built, including Valves and Matched P.M. Speaker, for approximately **£6/15/9**; or less valves for **£4/19/6**.
These Assembly Instructions are available for **1/6** (plus 3d. post), and in addition to the normal Wiring Diagram, they include practical layouts to enable the inexperienced Constructor to build the Set.

"MAINS or BATTERY PERSONAL KIT"
A complete KIT OF PARTS to build our new MIDGET 4-VALVE SUPERHET PERSONAL SET, covering MEDIUM and LONG WAVES and designed for MAINS or BATTERY operation is now available.
This 2 Waveband Superhet Receiver is designed to operate on A.C. mains 200/240 volts, or by an "All-Dry" Battery, either method being selected by means of a Rotary Switch. It is so designed that the Mains Section (size 4½in. × 1¼in. × 3¼in.) is supplied as a separate Kit, which may be added at any time. The kit therefore can be supplied either as an "All-Dry" Battery Personal Set, or as a Midget Receiver for combined Battery/Mains operation.
The circuit incorporates Delayed A.V.C. and Presclective Audio Feedback. A Rola 4in. P.M. Speaker with generous size Output Transformer ensures excellent quality reproduction. Ready Wound Frame Aerial. Fully aligned I.F. Transformers, and a Drilled Midget Chassis are included. Valve line-up:—1.R.5(F.C.)1 T.4 (I.F. Amp.) L.S.5 (Diode Det. and Audio Amp.) and S.3.4 (Output Tet.).
The Set is quite easily built from the very detailed assembly instructions supplied, which include a practical component layout, with Point-to-Point wiring, and a circuit diagram for both the Set and the Mains Unit.
Price of COMPLETE KIT (less Mains Unit), **£6/19/6**. Price of COMPLETE MAINS UNIT KIT, **£1/17/6**. EVER READY Type B14 BATTERY, **10/3**.
An attractive Walnut Finished Cabinet, size 9in. × 5in. × 5½in., of the hinged-lid type and suitable to house the combined set is available for **21/6**.
THE COMPLETE ASSEMBLY INSTRUCTIONS mentioned above can be supplied separately for **1/6**.
A Midget T.R.F. Battery Portable "Personal" Kit. A complete Kit of Parts to build a Midget 4-valve All-dry Battery Personal Set. Consists of Regenerative T.R.F. Circuit employing Flat Tuned Frame Aerial, with Denco Iron Dust Cored Coil, thereby ensuring maximum gain for Single-Tuned Stage covering Medium Waveband.
Valve line-up: 1T4 (R.F. Amp.), 1T4 (Detector), 1S5 (1st A.F.) and 3S4 (output). Includes latest Rola 5in. Moving Coil Speaker, and a Chassis already drilled and shaped. A consumption of only 7 m/a. ensures long battery life. The Kit is designed for a cabinet, minimum size 6½in. × 4½in. × 8in. Detailed Building Instructions, with Practical Layout and Circuit included with Kit to make assembly easy. **Price for Complete Kit, £4/11/6** (plus **16/7** P.T.). Suitable unpolished Cabinet 6½in. × 4½in. × 8in. **14/9**. Ever Ready B114 Battery **10/3**. Building Instructions, Circuits, etc., supplied separately, **1/-**.

A Complete Kit of Parts to build a **Midget "All-Dry" Battery Eliminator,** giving approx. 69 volts H.T. and 1.4 volts L.T. This Eliminator is suitable for all 4-valve Superhet Personal Set requiring H.T. and L.T. voltages indicated above. The Kit is quite easily and quickly assembled and is housed in a Light Aluminium Case, size 4½in. × 1½in. × 3½in. It can therefore be accommodated inside most makes of Personal Sets. Price of complete Kit, **£1/17/6**.
"Wireless World" Midget A.C. Mains 2-Valve Receiver. We can supply all the components, including valves and M/coil Speaker to build this set as specified in the March 1950 issue at a total cost of **£3/10/-**. Reprint of detailed assembly instructions and circuit supplied separately for **9d.**
"Wireless World" Midget A.C. Mains 3-Valve Receiver. Covering Long and Medium Wavebands. We can supply all the Components, including Drilled Chassis, Valves, Moving Coil Speaker, etc., to build this Set, as specified in the Feb. 1950 issue at a total cost of **£4/17/9** including a reprint of the complete Assembly Instructions and Circuit (this is available separately for **9d.**) and Practical Component Layout with "point-to-point" connections. An attractive **Walnut Finished Cabinet** is now available for this W/World 3-Valve Set at **21/-**, or it can be supplied with a complete Dial and Drive Assembly which includes the latest Station Name Dial and Dial Escutcheon, and a Combined Switch/Volume Control to effect very slight modification. Inclusive price, **35/-** (Dial and Drive Assembly with Switch/V. Control supplied separately for **14/-**).
We can supply all the Components, including Valves, M/Coil Speaker, etc., to build a **Midget A.C. D.C. Mains T.R.F. 3-Valve (Plus Metal Rectifier) Receiver** as designed and specified by a popular Technical Magazine, at a total cost of **£5/9/6**. A reprint of the assembly instructions, and layout available for **9d.**
An Entirely Complete 3-Valve Amplifier Kit of Parts. Operating on A.C. or D.C. mains 200-250 volts. Has an output of max. 4 watts, with valve line-up 25A6, 6J7 and U31. A matched 6in. Moving Coil Speaker is supplied. Price, including Wiring Diagrams, **£4/12/6**.
FOR UNDER £8!! A complete **KIT OF PARTS**, including Drilled Chassis and Valves, to build a **6 to 8 Watt Push-Pull Amplifier,** for operation on A.C. mains. Is suitable for use with Magnetic Crystal or Light-weight Pick-up and incorporates Tone Control. Theoretical and Practical diagrams supplied. Price of Complete Kit, **£5/18/9**. Price of Amplifier Chassis, completely assembled, **£7/10/0**. Circuit and component list separately **9d.**
TELEVISION!! The **"Viewmaster" Televisor,** assembly instructions showing Wiring Diagram and Practical Component Layout available for **5/-**. We have the specified Components, including the T.C.C.—Bulgin—Morganite—W.B.—Westinghouse.—Ploessey—Colvern, etc., outfits in stock. We can supply this Televisor by the individual stages (as published with the instructions) or by separate Components. Complete price details can be obtained on application.
A 2-POLE INDUCTION MOTOR, ideal for gram. motor, fans, etc., consumption 21 watts, speed (light), 2,750 r.p.m. **39/6**.
A 4-POLE INDUCTION MOTOR, ideally suited for gram motor, wire and tape recorders, and any application demanding a constant speed and vibration free motor. For A.C. mains, 100 to 250 volts operation, speed 1,400 r.p.m., consumption 14 watts, size 2½in. × 2 7/16in. × 1¾in. **47/6**.
THE NEW DECCA 3-SPEED GRAM. UNIT. A complete Unit, including Turntable and Pick-up for 33-45 and 78 r.p.m., price **£11/2/8**; or Motor and T/table only, **£7/3/4**; and Pick-up only (for 3 speeds), **£3/19/4**.
We have a limited number of COSMOCORD G-P.20 PICK-UPS in stock, price £3/11/5.

★ Send 6d. P.O. for our NEW STOCK LIST, showing many KITS OF PARTS for Sets and Battery Chargers and "hundreds" of Wireless Components. When ordering please include postage and packing.

STERN RADIO LTD., 109 and 115 FLEET STREET, E.C.4

Telephone: CENtral 5814 and 2280

CLYDESDALE

Bargains in Ex-Service Radio and Electronic Equipment

INEXPENSIVE TELEVISION

Ex U.S. NAVY. AN/APA-1 RADAR UNIT

Consists of an enclosed self-contained repeater amplifier unit with high frequency (400 cy.) power supplied, both E.H.T.-H.T. and L.T.
11 valves include: 1/2x2 EBT rectifier, 1/6x5 Rectifier 1/6J6 Power amplifier, 7/6SN7, R.F. Amplifier, 1/6H6 D/Diode, and 2 B.F.I. Cathode Ray Tube complete with base, metal shields mounting rack and 6 ft. core braided harness.
The unit is a wealth of components, *i.e.* condensers, resistors, etc., Circuit supplied with each unit.
CLYDESDALE'S PRICE ONLY **£4/19/6** each CARRIAGE PAID

VIEWING UNITS

Indicator Type 6 Series. These units are brand new in excellent condition and are all fitted with a VCR.97 CRT, the tube which many constructors have put to T.V. use. Valves include 4/VR93 (EF50), 3/VR54 (EB34), plus a host of potentiometers and H.V. condensers, etc.
The complete unit is enclosed in a metal box 16in. × 8½in. × 7½in.
CLYDESDALE'S PRICE ONLY **£3/19/6** CARRIAGE PAID

Please include 10/- for transit case to ensure safe transit of unit. Refunded on return of case.

12.25 MCS. I.F. STRIP

H.28A. I.F. Strip by Pye provides a very compact I.F. sub-chassis complete 8/6 valves. The Chassis is wired for IF operation and input leads are tag terminated at rear end of unit. Coax input and output sockets are mounted on the front panel. Dim. 16in. x 5 in. x 4½in.
CLYDESDALE'S PRICE ONLY **47/6** each POST PAID
Chassis, less valves, 17/6 each. Post paid.

I.F./VIDEO RECEIVER

The Ex-R.A.F. R. 1355 provides an excellent vision receiver and the RF section can be removed by sliding the complete unit free of the Receiver. An integral power pack for A.C. 200 v. Mains can be readily built in place of the existing 80 v. 2,000 C. pack.

The R. 1355 is complete with valves: 5 stages of I.F. at 7.5 Mc/s. (SP61), Detector (EA50), Video Amplifier (SP61), and Cathode Follower (SP61), EHT rectifier (5U2150), and H.T. rectifier (5U4G).
Complete in metal case 18 × 8½ × 7½in.
CLYDESDALE'S PRICE ONLY **67/6** each CARRIAGE PAID

EX-R.A.F. Indicator Unit 62 consists of a host of TV Components plus a VCR97 Cathode Ray Tube and various Valves 16/SP61s, 2/EB34s and 2 EA50s.
The Indicator Unit 62 circuit may be useful for your TV experiments in its existing state. Circuit details are available at 1/3 each.
Complete and enclosed in a metal case 18 × 8½ × 11½in.
CLYDESDALE'S PRICE ONLY **67/6** each POST PAID

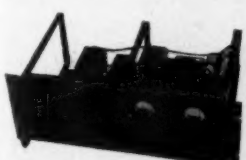
CIRCUITS

Circuits for the VIEWMASTER television receiver available price 5/-, for both (A) LONDON and (B) BIRMINGHAM frequencies. Circuits for Ex W.D. Radar equipment, i.e., R1355, Indicators 6 and 62, and various others also available at low prices.

MISCELLANEOUS

MODULATOR AMPLIFIER or WS36 P.S. UNIT

110/250 volt A.C. operated. Amplifier valve line-up is arranged as follows. The mic. input is transformer coupled to a 6C5 which is transformer coupled to 2/6C5's (in push pull, transformer coupled to 2/807's in push-pull Modulators). No modulation transformer is supplied.
The POWER SUPPLY section includes L.T. transformer input 110/250 v. output 4 v. at 4 a. (3 windings) supplying 3/AV1 rectifiers, also 1 2.25-0-2.25 v. at 8 a. supplying the amplifier (3/6C5's and 2/807's) also the transmitter (4/807's), also 1 200-0-200 v. 50 m/a. Bias winding. H.T. transformer input. 110/250 v. Output 500-0-500 v. at 200 m/a (twice), rectified by 2/AV1's (Mullard 4 v. rectifier). One supply goes to the transmitter whilst the other feeds the modulator. High voltage smoothing is carried out by a 4 mfd./1000 v. condenser followed by a choke and a 10 mfd./1000 v. condenser. The steel chassis and front panel are enclosed in a wooden box: 23½in. × 16in. × 13½in. with two carrying handles and a removable front. The front panel controls include: Local and Remote H.T. switch RT/SCW/CW switch, 16 way connector plug, HT indicator lamp, 2 way jacks, etc. Fully fused.
CLYDESDALE'S PRICE ONLY **£12/10/0** each CARRIAGE PAID



19 in. RACK MOUNTING A.C. MAINS POWER UNIT type 3.

A complete A.C. Mains power supply with variable input voltage tappings, switched 0-200/210/200/240/250 and fitted with 0-300 VDC. and 0-150 m/a. Meters in H.T. output circuits.
Double choke smoothing with paper condensers and 5Z4 rectifier. Output 200 V.D.C. 40 m/a. and 6.3 v. 3 a. An extremely versatile power pack.
Fully enclosed, 19 × 7 × 11in. finished grey, with handles.
CLYDESDALE'S PRICE ONLY **£4/10/0** CARRIAGE PAID

COMMUNICATIONS ENTHUSIAST and "HAM"

T.1154 C.W., M.C.W. "FON" TRANSMITTER

This transmitter can be operated at an input of up to 100 watts on C.W. and 60 watts on "FON." Employs a parallel Final arrangement of Two PT15 pentodes, and an ECO driver stage using an ML6, a further ML6 provides GRID MODULATION (approx. 60%), this stage also provides a means for Side Tone monitoring when the transmitter is on C.W. A carbon or electro magnetic microphone can be used.
The controls include: Frequency Selector (ECO), P.A. tuning and Antenna loading. Stand-by/Transmit switch and plate current meter (MAG FEED), together with R.F. amp. (output) meter.
Enclosed in a metal case, finished in black. 14 × 16½ × 8½in. 3 Waveband model.
CLYDESDALE'S PRICE ONLY **£7/18/6** POST PAID

FOR MARINE USE

The CRV46151 is a 6-valve superhet, suitable for shipping with a frequency coverage of 195-9050 Kc/s. 1 R.F. and 3 I.F. stages, plus an audio output stage. The 3rd I.F. stage provides CW osc.
VALVE LINE-UP: 4/12SF7, 1/12SA7, 1/12A6 and 1/991 stabilizer.
H.T. power is derived from a 23 v. dynamotor mounted sub-chassis, which has an output of 260 v. 70 mA. The valves are wired in series/parallel providing a 24 v. heater circuit.
Complete in metal case 15 × 8 × 7½in. Weight 26.8lb.
CLYDESDALE'S PRICE ONLY **£5/19/6** each CARRIAGE PAID

WS-18 RECEIVER

Ex-Army WS-18 Receiver Unit, constituting a 4-valve superhet chassis with a frequency range of 6 to 9 Mc/s (50 to 33.3 Metres). I.F. Freq. 465 Kc/s employing an ARP12 (VP23) F/changer, 2/ARP12s IF/LF and AR8 (HL23DD) audio, 2 det. and AVC. Headphone output. A very sensitive compact receiver with great possibilities.
Chassis 8½ × 5 × 1in. Front panel 9½ × 6½in.
Unused, good condition.
Requires only 3 v./3 a. L.T. 120 v./15 mA. H.T. 1.5 v. Bias.
CLYDESDALE'S PRICE ONLY **17/6** CARRIAGE PAID
Circuits available for Mk. I, II and III, at 2/3, post paid, or 4/6 post paid, for complete Tx/Rx Circuits.

EX-R.A.F. R1155 COMMUNICATIONS RECEIVER

With 7 valves 1/VR100 (KTW61) R.F. 1/VR99 (X65) Mixer, 2/VR100 (KTW61) I.F.'s 1/VR101 (DH63) 1st Audio—2nd Det.-AVC, 1/VR101, (DH63) B.F.O.—CW Filter, Y63 Tuning Indicator.
5 wavebands: 18 to 7.5 Mc/s (16.6 to 40M) 7.5 to 3.0 Mc/s (40 to 100 M) 1,630-600 Kc/s (200 to 500 M) 600 to 200 (500 to 1,500 M), 200 to 75 (1,500 to 4,000 M).
Back lash free, ultra slow motion drive making 20 Metre tuning a pleasure. Full vision half-moon dial graduated in Mc/sand Kc/s.
In metal case, finished black. 16½ × 9 × 8in.
CLYDESDALE'S PRICE ONLY **£12/12/0** CARRIAGE AND PACKING PAID
This receiver can be supplied together with an A.C. mains power pack, with integral amplifier—end stage and 8in. speaker.
Complete and contained in a metal cabinet finished grey, with linking cables, plugs and circuits.
14 × 14 × 7in.
CLYDESDALE'S PRICE ONLY **£18/10/0** CARRIAGE PAID

"P MOBILE ON '2'

Modifications to the R28/ARC5 10 valve V.H.F. receivers oscillator stage and the general tuning up on to 144 Mc/s shouldn't prove to be terribly difficult, and a compact "car radio" style 2 Metre receiver is the result.
Valves include: 7/ 7474 (mushroom) pentodes, these valves have an extremely favourable signal/noise ratio, with high gain, as 5 provide the RF amplification of the R28/ARC5.
Power requirements: 220 V.D.C. at 70 mA H.T., and 28 v. L.T.
This unit is in the same class as the Command Receivers.
CLYDESDALE'S PRICE ONLY **37/6** each POST PAID

BRAND NEW In Original Wood Case

Ex. Cdn. Army, Supply Unit Rectifier for No. 43 Tx. This Unit is 3 complete power supplies H.T., L.T. and Bias supply with an input of 110 v. A.C. 50/60 cyl. 1.7 KVAs. All smoothing is double-choke, condenser input circuits. H.T. starters, and stabilizers. Power-Transformers, 2,100-500-0-500-2,100 v. 400 m.A. 450-0-450 v. 13 v. ct. 6.3 v. 6.3 v. Fil. Trans. 2.5 v. ct. twice and 6.3 v. thermal starter transformer.
Outputs: 2,100 v. H.T. 375 mA, 500 H.T. 500 mA., 385 v. regulated, 450 v. H.T. line, 415 v. neg. bias, 300 v. neg. bias, 150 v. neg. bias, 80 v. neg. bias.
The complete unit is mounted in a metal case with lid. 24½ 6in. × 15½ 6in. × 18½, finished in silver-dust crackle, and fitted with shock absorbing feet. Weight 420lb.
CLYDESDALE'S PRICE ONLY **£16** CARRIAGE PAID

MAINS SHADED POLE MOTORS

H.313. shaded pole end thrust motor, 1,500 r.p.m. at 1/100 h.p., fitted with 3/16in. spindle ¾in. long. Threaded fixing lugs. Dim. 4 × 3¼in. Weight 5½lb.
CLYDESDALE'S PRICE ONLY **30/-** each POST PAID
H.314. Details for this motor as above but fitted with ¼in. screw shaft. Dim. 4 × 3¼in. Weight 4lb.
CLYDESDALE'S PRICE ONLY **22/6** each POST PAID
S.R.I. Carefully balanced, rugged, and very efficient motor. 500mA room tested. Can be run at gross overloads without damage.
CLYDESDALE'S PRICE ONLY **25/-** each POST PAID
S.R.1. Details as for S.R.2. 2,000 r.p.m. Shaft diam. .1875in. Fitted. Silent room tested.
CLYDESDALE'S PRICE ONLY **32/-** each POST PAID

MAGNETIC COMPASS

H.486. Magnetic marching compass MK. I for day or night use enclosed in a black bakelite case, 3 × 3½ × 1¾in., complete with instructions for use.
CLYDESDALE'S PRICE ONLY **21/-** each POST PAID

Order direct from :—

CLYDESDALE SUPPLY CO. LTD. 2 BRIDGE STREET GLASGOW · C-5

Phone : South 2706/9. Branches in Scotland, England and Northern Ireland.

LASKY'S RADIO

The World Renowned Junior Radio Store

T.V. SCAN COILS FOR LINE AND FRAME. Brand new, manufacturer's surplus. For 9in. or 12in. c.r. tubes.
LASKY'S PRICE 14/6 Post 1/-.

P.M. TELEVISION FOCUS MAGNETS Suitable for any type of cathode ray tube. Tetrode
LASKY'S PRICE 15/- Postage 1/- extra.
Triode
LASKY'S PRICE 16/11 Postage 1/- extra.

GERMANIUM CRYSTALS.
LASKY'S PRICE 3/- each. 8 for 20/-. Post Free

PHOTO ELECTRIC CELLS TYPE VA28. Requires 100 volts D.C. or peak A.C. to function. Ideal for experimental work.
LASKY'S PRICE 12/6 Postage 1/6 extra.

DE LUXE TELEVISION CABINETS. For 9, 10 or 12in. cathode ray tubes. Beautiful figured medium walnut finish, with high polish. Fitted with shelf for receiver, glass, speaker baffle and fret, rear tube protector, and castors for easy movement. Undrilled
LASKY'S PRICE £8.10.0
Carriage 12/6 extra.
Outside dimensions of cabinet: 16½in. × 16½in. × 32in. high.

PACKARD BELL TYPE K. MICROPHONE PRE-AMPLIFIERS. BRAND NEW AND UNUSED. Contains 2 valves, 1 6SL7 twin triode and 1 28D7 twin pentode. Also associated components, input and output transformers, etc. Contained in lightweight metal case. Size: 4½in. × 5in. × 4in. Designed to increase the output of low gain pick-ups and microphones. Supplied with full circuit and details.
LASKY'S PRIC. 16/6
Postage 1/6 extra.

I.F.F. RECEIVER TYPE R3108. BRAND NEW AND UNUSED. IN ORIGINAL CARTONS. Contains 8 new valves: 4 SP41, 1 EA50, 1 VR78, 2 CV6. Also a host of components, coils, condensers, resistances, etc. A motor generator with input of 24 volts, and output of 480 volts.
LASKY'S PRICE 25/-
Carriage 3/6 extra.

BRAND NEW IN ORIGINAL CARTONS. **6 or 12 VOLT VIBRATOR UNITS.** (Manufactured in U.S.A.) Supplied complete with 4-pin non-synchronous vibrator and either 0Z4 or 6X5 rectifier. Output 300 volts, 60-80 m/a. Size: 7in. × 5in. × 3½in.
LASKY'S PRICE 27/6
Postage & Packing 2/6

COMMUNICATIONS RECEIVER. TYPE P.C.R. By Philips. Perfect condition. Aerial tested before despatch. 6 valve superhet circuit: R.F., F.C., two I.F.s, D.D.T., pentode output. Frequency coverage: 16-50 mtrs.; 200-550 mtrs.; 800-2,500 mtrs. Fitted in metal case, black crackle finish, with built-in loudspeaker. Flywheel tuning. May be used with any suitable power pack. Supplied complete with 6 brand new Mullard valves. 3 EF39, 1 ECH35, 1 EBC33, 1 EL32.
LASKY'S PRICE £10.10.0 Carriage 10/- extra.
Power pack for P.C.R. Receiver. 12 volt.
LASKY'S PRICE 39/6 Carriage 5/- extra.

CAR RADIO PLUG SUPPRESSORS. Brand new Ex-Govt. Normally listed at 1/6 each.
LASKY'S PRICE 1/- each, 10/- per dozen. Post Free.

AMERICAN AIR CORPS RECEIVER TYPE BC454. Brand new in original cartons. Frequency range 3-6 Mc/s. Contains 6 valves: 3 12SK7, 1 12K8, 1 12A6, 1 12SR7. Also dozens of miniature components, resistances, condensers, etc. Built in black crackle metal case, lightweight size, 11in. × 5in. × 5½in. Weight 10lb.
LASKY'S PRICE 55/- Carriage 3/6 extra.

PLESSEY TELEVISION

Line EHT Trans.	21/3
Focus Ring	19/6
Line width coil	8/9
Boost choke	5/-

SELENIUM METAL RECTIFIERS
12 volts 6 amps., **27/6**, post **9d.** extra.
12 volts 1 amp., **7/9**, post **9d.** extra.
12 volts ½ amp., **3/11**, post **6d.** extra.
350 volts 80 M/a., **7/11**, post **6d.** extra.
250 volts 60 M/a., **6/6**, post **6d.** extra.
Meter Rectifiers 5 M/a., **6/6**, post **6d.** extra.

Limited Quantity
L.S.L. PORTABLE VALVE AND CIRCUIT ANALYSER.
LASKY'S PRICE £10.19.6
Complete. Carriage 10/- extra. Brand new and unused. Details available.

RADAR INDICATOR UNITS TYPE 162C. BRAND NEW IN MAKER'S ORIGINAL WOOD CASE. Contains 2 cathode ray tubes, one 6in. VCR517 and one 3in. VCR139. Also the following valves: three SP61, one 6J5, three EA50, one D1. Dozens of components, coils, resistances, condensers, seven pot. meters, etc. Enclosed in metal case, size 12in. × 9in. × 19in. Weight 40lb.
LASKY'S PRICE 79/6
Carriage 7/6 extra.

The 162C Indicator, less the VCR139.
LASKY'S PRICE 59/6
Carriage 7/6 extra.

EX A.H. RADAR INDICATOR UNIT TYPE 62. Unused but soiled. Containing 20 valves and a 6in. C.R. tube type VCR97. Valve line-up: 16 SP61, 2 EA50, 2 EB34. Dozens of components, resistances, coils, condensers, 117 Mc/s crystal, pot/meters, etc. Totally enclosed in metal case. Size: 18in. × 9in. × 11in. Weight 40lbs. Enamelled grey or black with coloured control knobs.
LASKY'S PRICE 89/6
Carriage 10/- extra.

MAINS TRANSFORMERS.
Primary 200-250 volts 50 c.p.s. Type MBA/3. 350-0-350v. 80 M/a.; 6.3v. 3a.; 5v. 2a. Both filaments tapped at 4 volts.
LASKY'S PRICE 20/-
Postage 1/6 extra.
Type MBA/4. 270-0-270v. 80 M/a.; 6.3v. 3a.; 5v. 2a.
LASKY'S PRICE 16/11 Postage 1/6 ex.

WEARITE MINIATURE I.F. TRANSFORMERS.
Iron dust cores. Frequency range 456-475 Kc/s. Size: 1¼in. high × ¾in. × ¾in.
LASKY'S PRICE 14/- per pair.
Postage 6d. extra.

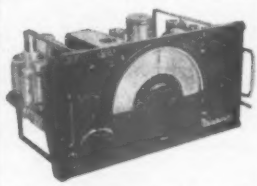
CONDENSERS. ALL BRAND NEW.

8 mfd. 500 v.w.	3/3
8 mfd. 450 v.w.	3/-
16 mfd. 500 v.w.	3/9
16 × 16 mfd. 450 v.w.	4/6
25 mfd. 25 v.w.	1/11
8 × 16 mfd. 500 v.w.	4/9
60 × 100 mfd. 350 v.w.	8/6
64 mfd. 500 v.w.	6/9

Postage extra.

EX-A.M. RECEIVERS TYPE R1132A and R1481. BRAND NEW AND UNUSED, IN ORIGINAL WOOD CASES. Frequency coverage: R1132A, 100-124 Mc/s.; R1481, 66-86 Mc/s Description: Contains 11 valves: 1 VR65, 1 VR66, 4 VR53, 2 VR54, 1 6J5, 1 VS70, 1 VR57. Large tuning scale with slow motion drive, 0-5 m/a tuning meter, R.F. and L.F., gain controls, jack sockets for line and 'phone. Totally enclosed in metal case, grey enamelled, with plated handles. Size 18in. × 10in. × 11in. Weight packed, 54lbs. Supplied complete with circuit and calibration chart.
LASKY'S PRICE 99/6 each. Carriage 10/- extra.

EX-A.M. COMMUNICATION RECEIVER TYPE R1155.
BRAND NEW IN WOOD TRANSIT CASE. Aerial tested before despatch. Supplied complete with 10 valves. Circuit: B.F.O., A.V.C., R.F. Amp., two I.F. stages, magic eye, etc. 5 frequency ranges: 18.5-7.5 Mc/s.; 7.5-3.0 Mc/s.; 1,500-600 kc/s.; 500-200 kc/s.; 200-75 kc/s.



LASKY'S PRICE
£12.10.0
Carriage (in wood case), 7/6 extra.

Full modification data and circuit details supplied free with each receiver. Power pack and output stage for the R1155, as described in the modification instructions. Fully assembled, and supplied with output valve and rectifier. In black enamelled case ready for use.
LASKY'S PRICE 79/6 Carriage 5/- extra.

SAFETY FIRST. Fused test prods. Fully insulated pencil type with retractable point. Contact is only made when desired by pressing top. Each prod contains a cartridge type fuse and spring.
LASKY'S PRICE 4/11 per pair (one red, one black).
Post 6d. extra.

LASKY'S RADIO

370 HARROW ROAD, PADDINGTON, LONDON, W.9

(Opposite Paddington Hospital)
Telephones: CUNningham 1978 and 7214
Hours: Mon. to Sat. 9.30 a.m. to 6 p.m., Thurs. half day 1 p.m. Send a 2½d. stamp with your name and address (in block letters please) for a copy of our current stock list giving details of our supplies of new manufacturers' surplus equipment and ex-Government radio, radar and valves, etc.

TELEVISION

SOUND & VISION ON A SINGLE CHASSIS

SIZE: 10" LONG, 4½" WIDE, 1" DEEP

MADE POSSIBLE BY USING THE LATEST MINIATURE VALVES

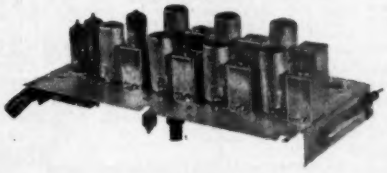
LASKY'S RADIO — World Renowned for Service & Reliability

LONDON & BIRMINGHAM FREQUENCIES

10 VALVES

VALVE LINE UP.

V1.	6AM6.	Sound and vision R.F. amp.
V2.	6AM6.	Sound 2nd RF. amp.
V3.	6AM6.	Vision 2nd RF. amp.
V4.	6AM6.	Sound 3rd RF. amp.
V5.	6AM6.	Vision 3rd RF. amp.
V6.	6AL5.	Sound detector and noise limiter.
V7.	6AL5.	Vision detector and noise limiter.
V8.	6AM6.	Sound output.
V9.	6AM6.	Sync. pulse separator.
V10.	6AM6.	Video output.



LASKY'S PRICE £6 19 6

Carriage 3/6 extra.

Complete with all valves NO EXTRAS

LONDON CHASSIS CONVERTS EASILY TO HOLME MOSS

These units are not ex-Government, but brand new manufacturer's surplus. May be used with any type time base and c.r. tube. The unit is fully assembled and wired, supplied with all valves and ready for fitting. Voltages required: 6.3 v. at 3 amps. and 270 v. at 80 m/a.

Send 6d. for a copy of the full data, circuits and photographs dealing with this unit. SAVES—SPACE, TIME, CASH.

Sold only at

LASKY'S RADIO

Telephones: CUNningham 1979 & 7214.

370 HARROW ROAD, PADDINGTON, LONDON, W.9.
(opposite Paddington Hospital)

Hours: Mon. to Sat. 9.30 a.m. to 6 p.m. Thurs. Half Day 1 p.m.

ALEC Davis SUPPLIES Ltd.

DEPT. W.W.

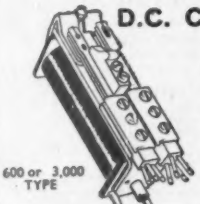
18 TOTTENHAM COURT ROAD, LONDON, W.1

Tel: MUSeum 2453 Tel: MUSeum 4539

Shop hours: Monday - Friday 9—5.30. Saturday 9—1

FULL MAIL ORDER FACILITIES. ***Please add postage.***

RELAYS (EX-MINISTRY)



600 or 3,000 TYPE

D.C. COIL RESISTANCE

3,000 TYPES: 1.9Ω to 80,000Ω

600 TYPES: 0.4Ω to 9,200Ω

ALSO LARGE STOCKS OF DOUBLE & TRIPLE-WOUND AND SLUGGED COILS.

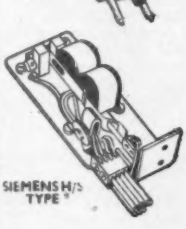
CONTACTS

3,000 TYPES: up to 8 sets.

600 TYPES: up to 4 sets.

3,000 TYPES: Make (M), Break (B), in Twin-silver, Twin-platinum, Dome-silver (2 amp), Tungsten (5 amp.), and Flat-silver (8 amp.). Change-Over (C), in all but Tungsten: Make-Before-Break (K), in Twin-silver and Twin-platinum.

600 TYPES: (M), (B), and (C), in Twin-silver and Twin-platinum.



SIEMENS H/S TYPE

SPECIAL

3000 type Relays with 80,000Ω coils operating on approx. 600 Micro Amps with up to four sets of contacts.

I.F. TRANSFORMERS

Wright and Weaire 501 and 502 465 Kc/s I.F. Transformers 10/-

Wright and Weaire Midget 465 Kc/s I.F. Transformers 400 and 406B

Per pair £1 1 0

Manufacturers Surplus Permeability tuned 465 Kc/s I.F. Per pair 10/6

COIL PACKS

Wright and Weaire types 705 and 706 ..... 37/10

Type 705 Covers the usual short, medium and long wavebands.

Type 706 covers two short and the medium waveband.

OSMOR MINIATURE COIL PACKS

Osmor L.W.S. Coil Pack £2 4 0

Osmor L.M.S. H.F. Unit 18/4

Osmor L.M.S. Battery Coil Pack £2 5 0

Osmor M.S.S. Coil Pack £2 0 10

Osmor L.M.T.S.F. Coil Pack £1 16 8

TUNING CONDENSERS

2 Gang .0005μF with Trimmers 8/6

2 Gang .0005μF Midget 7/6

2 Gang .0005μF 7/6

2 Gang .0002μF 4/6

DIAL ASSEMBLY

J.B. Full Vision 3-wave band dials 11/9

J.B. SL5 3-wave band assembly 24/-

J.B. SL8 3-wave band assembly with fly-wheel tuning 25/-

Osmor 3-wave band dial assembly 7in. × 2in. drive mechanism..... 24/6

BAKELITE RECEIVER CABINET size 12in. × 8in. × 6in. high in brown or ivory. Supplied complete with ready-drilled 4 v. T.R.F. chassis, with cut-out for 5in. speaker 2-wave-band glass dial, back plate, mounting brackets and back. Only 25/-. Plus 1/- postage. Drum and Drive and pointer to suit, 3/-.

ALUMINIUM CHASSIS

9in. × 6in. × 2in. 5/-

11in. × 5in. × 2in. 5/6

13in. × 9in. × 2½in. 7/11

Postage 6d. per chassis.

A.D.S. 4) w. QUALITY AMPLIFIER complete set of components for the above amplifier including cabinet, chassis, etc.. £7/15/-.

Complete amplifier constructed and tested. £9/17/6.

Full constructional details of our 4½-w. amplifier including circuit diagram and lay-out picture 10d.

ACOS MICRO-CELL PICK-UP

GP20 with standard head £3 11 5

GP20 Heads for standard or microgroove £2 3 4

"DESCO" ALIGNMENT OSCILLATOR D.A.O.I. This unit provides a modulated signal for the alignment of I.F. Amplifiers and associated circuits. The two standard frequencies of 465 Kc/s and 1600 Kc/s are selected at the turn of a switch. All supplies are obtained from a 9 v. G. Blaz Battery. Price only £7 6, plus 1/- postage

RADIO SUPPLY CO.

34, HANOVER STREET, PARK LANE, LEEDS, 1. *(Telephone 22153)*

Post Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/2 charged on orders under £2. Open to callers 9 a.m. to 5.30 p.m., Sats., until 1.0 p.m.

R.S.C. MAINS TRANSFORMERS

Fully Guaranteed, Interleaved, and Impregnated. Primaries 200-230-250v., 50 c/s. Screened.

DROP THROUGH TYPES WITH TOP SHROUD

260-0-260 v. 70 ma., 6.3 v. 2 a., 5 v. 2 a.	12/11
350-0-350 v. 70 ma., 6.3 v. 2 a., 5 v. 2 a.	14/11
350-0-350 v. 80 ma., 0-4-6.3 v. 2 a., 0-4-5 v. 2 a.	18/9
260-0-260 v. 90 ma., 6.3 v. 3 a., 5 v. 2 a.	17/6
350-0-350 v. 90 ma., 6.3 v. 3 a., 5 v. 2 a.	18/9
250-0-250 v. 100 ma., 6.3 v. 4 a. 5 v. 3 a.	21/9
250-0-250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a., for R1355 conversion	23/11
350-0-350 v. 100 ma., 6.3 v.-4 v. 4 a. C.T. 0-4-5 v. 3 a.	21/11
350-0-350 v. 120 ma., 6.3 v. 4 a., 5 v. 3 a.	25/9
350-0-350 v. 150 ma., 6.3 v. 4 a., 5 v. 3 a.	27/11

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 ma., 6.3 v. 2 a., 5 v. 2 a., Midget type 2½-3-3in.	16/11
350-0-350 v. 70 ma., 6.3 v. 2 a., 5 v. 2 a.	18/9
250-0-250 v. 100 ma., 6.3 v.-4 v.-4 a. C.T., 0-4-5 v. 3 a.	23/9
250-0-250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a., for 1355 Conversion	26/9
300-0-300 v. 100 ma., 6.3 v.-4 v. 4 a. C.T., 0-4-5 v. 3 a.	23/9
350-0-350 v. 100 ma., 6.3 v.-4 v. 4 a. C.T., 0-4-5 v. 3 a.	23/9
350-0-350 v. 120 ma., 6.3 v. 4 a., 5 v. 3 a.	27/9
350-0-350 v. 150 ma., 6.3 v. 2 a., 6.3 a. 2 a., 5 v. 3 a.	29/11
350-0-350 v. 250 ma., 6.3 v. 6 a., 4 v. 8 a., 0-2-6 v. 2 a., 4 v. 3 a., for Electronic Eng. Televisor	63/-
425-0-425 v. 200 ma., 6.3 v.-4 v. 4 a. C.T., 6.3 v.-4 v. 4 a. C.T., 0-4-5 v. 3 a., suitable Williamson Amplifier	47/6
325-0-325 v. 20 ma., 6.3 v. 0.6 a., 6.3 v. 1.5 a., for Williamson Preamplifier	16/9

FILAMENT TRANSFORMERS

All with 200-250 v. 50 c/s. primaries : 6.3 v. 2 a., 7/6 ; 0-4-6.3 v. 2 a., 7/9 ; 12 v. 1 a., 7/11 ; 6.3 v. 4 a., 14/9 ; 6.3 v. 6 a., 16/9 ; 0-2-4-5-6.3 v. 4 a., 16/9 ; 24 v. 1.5 a. or 24 v. 3 a. 16/9

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s. Primaries :
0-9-15 v. 1.5 a., 12/9 ; 0-9-15 v. 3 a., 15/9 ;
0-9-15 v. 6 a., 21/9 ; 0-4-9-15-24 v. 3 a., 21/9 ;
0-9-15-30 v. 3 a. 22/9

SMOOTHING CHOKES

200 ma. 5 h. 100 ohms	7/6
100 ma. 10 h. 100 ohms.	7/6
80 ma. 12 h. 350 ohms.	5/3
60 ma. 15 h. 400 ohms.	4/6
40 ma. 10 h. 350 ohms	3/3

FILAMENT AUTO TRANSFORMERS

6.3 v. to 4 v. 3 a., or 4 v. to 6.3 v. 3 a. 7/11

ELIMINATOR TRANSFORMERS

200-250 v. 50 c/s. input, 120 v. 40 ma. output 7/9

OUTPUT TRANSFORMERS

Midget Battery, Pentode 66 : 1 for 354, ecc.	3/6
Medium Pentode, 5,000 ohms to 3 ohms	2/9
Standard Pentode 8,000 ohms to 3 ohms	4/6
Multi ratio 40 ma., 30 : 1, 45 : 1, 60 : 1, 90 : 1 Class B Push-Pull	5/3
Push-Pull 10-12 watt 6V6 to 3 or 15 ohms	15/11
Push-Pull 10-12 watt to match 6L6, PX4, 6V6, etc., to 3-5-8 or 15 ohm speaker ...	15/11
Push-Pull 15-18 watt to match 6L6, etc., to 3 or 15 ohm speaker	21/9
Williamson type exact to author's spec....	72/-

RECEIVER CHASSIS, 16 s.w.g., Aluminium : 10-5½-2in., 3/3 ; 11-6-2½in., 3/9 ; 12-8-2½in., 4/6 ; 16-8-2½in. 5/6

AMPLIFIER CHASSIS, 16 s.w.g., Aluminium : 12-8-2½in., 6/6 ; 16-8-2½in., 7/11 ; 20-8-2½in. 10/6

MISC. ITEMS, T.V. Masks, 12in., White, 12/9. Ex Govt. Chokes, 100 ma., 10 h., 100 ohms., tropicalised 4/3 each, 45/- doz. Ex-Govt. Selenium Rects., 12/24 v. 1 a. H.W. 3/6 each. Ex-Govt. Receiver Units, type 71, less valves, 7/6. Ex-Govt. Condensers, block paper, 1 mfd. 1,000 v., 4/9 doz. Vol. controls with D.P. switch, spindle, 1in., 25K, 2/9 ea., less switch 55K, 1/6. Sectional Aerial Rods, Copperised steel, 1ft. in length, ¼in. diameter, 1/11 doz., 15/- gross.

BRAND NEW GOVT. SURPLUS VALVES (boxed). 954, 955, 956, 2/9 ; 9004, 1/11 ; VR91, 6/6 ; VU133 3/9.

TRIMMERS AND PADDERS

4-40 pfd., 3/11 doz. ; Twin types 50-150 pfd., plus 50-150 pfd., 11/- doz. ; 10-100 pfd., plus 100-500 pfd., 10/6 doz. ; 100-600 pfd., plus 100-600 pfd., 14/- doz.

EX-GOVT. ELECTROLYTICS

50 mfd. 12 v. Solar Cans, 6/9 doz. ; 16 mfd. 175 v. cans, 5/3 doz. ; 10 mfd. 25 v. Met. Tubs, 5/9 doz.

FULL RANGE OF STANDARD COMPONENTS AVAILABLE AT KEEN PRICES. ALL GOODS GUARANTEED AND NEW, UNLESS OTHERWISE STATED. WE CAN QUOTE FOR ANY TYPE OF CHOKE OR TRANSFORMER, (EXCEPT E.H.T.). S.A.E. PLEASE WITH ALL ENQUIRIES. FULL STOCK LIST, 3d. SPECIAL LIST FOR TRADE, 3d.

ASSOCIATED ILIFFE TECHNICAL BOOKS

The books listed below are usually obtainable at all booksellers. In case of difficulty, enquiries should be made to : **The Publishing Dept., Dorset House, Stamford Street, London, S.E.1.** *Complete list of titles sent on application*

WIRELESS DIRECTION FINDING. *4th Edition.* By R. Keen, B.ENG. (HONS.), A.M.I.E.E.
This manual treats the subject of Direction Finding historically, descriptively and with a wide range of bibliographical references. A completely new chapter in this edition deals with systems of navigation using the hyperbolic grid, and an outline is also given of the application of the Principle of Least Squares to the plotting of a wireless fix. The chapter on Aircraft Approach and Landing Systems now covers progress since 1938 and describes the system developed by the U.S. Army Air Force as " SCS-51." Systems of direction finding which employ special methods of presentation, including automatic systems, are also dealt with and several examples of modern equipment are included.
1059 *pages.* 8¾ in. x 5½ in. 630 *illustrations.* 45*s. net. By post* 45*s.* 10*d.*

RADIO LABORATORY HANDBOOK. *5th Edition.* By M. G. Scroggie, B.SC., M.I.E.E.
Describes the methods available for carrying out tests and measurements, using either commercial instruments or improvised equipment. The subject matter includes the principal sources of power and signals, the various types of measuring and acoustic instruments, methods of comparison and their application to receivers and amplifiers, and the plotting and interpretation of results. A special chapter deals with laboratory technique for VHF work, constructional details of capacitance and resistance and inductance bridges, while much useful general information is given on such varied subjects as musical scales, decibels, wire gauges, filters, building one's own gear, etc.
7 x 4¼ in. 430 *pp.* 169 *diagrams and* 46 *photographs.* 15*s. net. By post* 15*s.* 5*d.*

ELECTRONS, ATOMS, METALS AND ALLOYS. By William Hume-Rothery, M.A., D.SC., F.R.S.
An elementary introduction to atomic theory with special reference to metals and alloys. The subject matter is presented in the form of a dialogue between an Older Metallurgist and Younger Scientist.
8¾ in. x 5½ in. 377 *pages.* 165 *illustrations.* 25*s. net. By post* 25*s.* 6*d.*

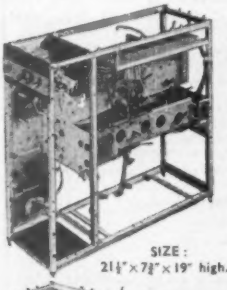
CONSTRUCTORS!!

HERE'S A BARGAIN FOR YOU!

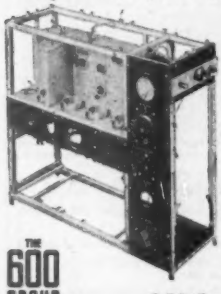
POUNDS WORTH OF COMPONENTS FOR ONLY 5/-

The home constructor should derive a lot of satisfaction from this chassis—it contains so much of value to him. It might even have the very component he has been looking for.

The light but immensely strong steel framework, paxolin and aluminium panels, stand-off insulators and the innumerable lengths of high-quality, beautifully insulated leads are all worth far more than is being asked for the whole chassis.



SIZE: 21¼" × 7¾" × 19" high.



READ THIS:—

Average Contents (all new and unused).

10 Pin Plug Strip

5 250 K. 1-watt Resistors.
4 100 ohm. 1-watt Resistors.
2 600 v. 1 mf. Condensers.
9 High-voltage Condensers, .0001 to .01.
1 3-way Switch.
2 H.F. Chokes.
1 Relay Switch.
1 Ceramic Valve Holder.
Lamp fuse with holder.
Spring Terminals.
Paxolin Panel 6½in. x 5in.
Aluminium Panel, black finished.
Large number Multi-coloured sleeved leads.
Very strong steel framing.
Innumerable Nuts and Bolts, Soldering points.
Stand-off Insulators, etc., etc.

The whole outfit, weight 18 lbs. sent to any address for only 5/-, plus 3/6 part cost of packing and carriage.

SPECIAL OFFER: 4 for 25/-, carriage paid.

THE 600 GROUP OF COMPANIES

Satisfaction Guaranteed or Money Refunded in Full

THE NEW LONDON ELECTRON WORKS, Ltd.

Dept. 92, EAST HAM, LONDON, E. 6.

Telephone: Grangewood 0044-1363

OUTSTANDING OFFERS OF INTEREST TO AIRCRAFT COMPANIES AND RADIO AMATEURS

EDDYSTONE 640. As brand new. One only **£24.** Carriage paid.

R107 RECEIVERS. As advertised last month, **16** gns. **1155 RECEIVERS.** Brand new, in cases, **10** gns. Carriage 7/6.

OF INTEREST TO AIRCRAFT COMPANIES. Approximately 2,000 assorted instruments. Comprising Fuel Gauges, Brake Gauges, Altimeters, Airspeed Indicators, Temperature Gauges, De-icer Gauges, Thermo Indicators, Oil Gauges, Pressure Indicators, etc. Special attractive price clearing the lot. Approximately 1,000 brand new and boxed aircraft instruments at bargain prices. Please state wants.

AIRCRAFT GENERATORS. Type 5U562. 12 v. 500 w. Brand new. Enquiries invited.

CHOKES. R.C.A. Heavy Duty 110C/2673. Weight 19lbs. Made for ET4336 or any heavy duty purpose, **10/-** each. Carriage 2/6.

DRIVER TRANSFORMERS. R.C.A. 110K/117 working into 2 805's, weight 5lbs., 4½ x 3½ x 3in. Brand new. Made for ET4336, **10/-**, post 1/-.

CRYSTAL MULTIPLIERS, MI 19468. Brand new. With case. Less MA meter, **25/-**, carr. 2/6.

TUNING UNITS. CAY 47151a 800-1,500 kcs. Brand new with case and lid, **15/-**, less case, **12/6.** Carriage 2/6.

RF 24 UNITS. Complete with 3 valves. 20-30 mcs. 5 spot frequencies, **21/-**, post 1/6.

VOLTAGE CONTROL UNITS. Type C3. Has On/Off switch. Pilot light, 6 bank fuse panel, 5 mfd. and 3 mfd. Heavy duty mains noise filter. Excellent case. Brand new, **12/6**, carr. 1/6.

TELEVISION PRE-AMPLIFIERS. Fitted with EF50 valve. Very compact. Available for London and Birmingham. Co-ax. input and output sockets. Power requirements 6.3 v. LT 200/275 HT. Effects an enormous improvement in all fringe areas, **15/-**, post 1/-

PAMPHONIC PA SPEAKERS. Brand new. Maker packing. 10in. high flux unit. 3 ohms. Handsome maroon cabinet. 20 x 13 x 9, **55/-**, carr. paid.

TYPE 87 ROTARY POWER UNITS. Input 24 v. Output 250 v. 65 mA. 6.4 v. 2.5 a. Length 8½in. Depth 7in. Width 4½in. Elaborate smoothing unit in base. Very neat case. Brand new, **10/-** each, post 1/6.

AMERICAN TRANSFORMERS. Potted. 115 v. 60 c. Output 420-0-420 0.115 a. 6.5 v. 7 a., **10/-**. Specify KS9063.

WESTINGHOUSE L406784. Shrouded 115 v. Output 3890 v. .0023 a. 2.5 v. 3 a. Beautiful job, **10/-**, post 1/6.

WESTINGHOUSE 301164. Input 115 v. Output 6.3 v. 10 a. 6.3 v. .6 a. 5 v. CT 3 a. 850 v. CT .142 a. 65 v. .142 a., **10/-**, post 1/6. We have about 500 other assorted American mains transformers which we will clear to a bulk buyer at a nominal price. Buyer must inspect. No lists.

SCR522. Two only in brand new condition, complete with all valves and crystals. 2 petrol generators. (1 minus petrol tank), **£100** the 2. A snip.

We shall be pleased to show bulk buyers round our stock.

H. P. RADIO SERVICES LTD.

Britain's Leading Radio Mail Order House

Established 1935

55, COUNTY RD., WALTON, LIVERPOOL, 4

Tel.: Aintree 1445 Staff Call Signs, G3DGL, G3DLV

For Quality Bargains Always —Best Buy at Britain's

Communications Receiver Type R1155. A number of these very famous Receivers still available, and they are in perfect working order and serial tested. Although not absolutely new, they are nevertheless in excellent condition and represent sound value for money at £7/19/6 to callers or despatched in maker's transit case for only 10/- extra. Any set gladly demonstrated. A revised and enlarged "Wireless World" leaflet dealing with this set is available at 1/3 post paid.

R1155 Power Pack/Output Stage. Enables the Receiver to be operated direct from A.C. Mains. Just plug in and connect low impedance speaker. (Note : speaker NOT supplied). The price is only £3/19/6.

Receiver R3547. Contains 15 of EF50, 1 of VR56 (EF36), 1 of VR55 (EBC33), 2 of VR116, 3 of VR54 (EB34), 1 of VR92 (EA50), and a 45 Mcs. "Pye" Strip ; also included are 11 pot'meters, a motor with gear box, relays and numerous other small components all mounted on an extremely useful chassis. BRAND NEW IN TRANSIT BOXES. Only £5/19/6, carriage paid to your door.

45 Mcs. "Pye" Strip. A ready made vision receiver (London frequency). Uses 6 of EF50 and an EA50. Complete circuit data provided. Less valves, 39/6, with all valves 62/6. In brand new condition.

Receiver Type 21. A battery operated superhet receiver covering 4.2-7.5 Mcs. and 19-31 Mcs. Operates as a double superhet on the 10 metre band. Complete with nine 2 v. valves and circuit diagram. 45/-, carriage paid. In new condition.

Command Receiver Type BC455. Frequency range 6-9 Mcs. Valve line-up : 3 of 12SK7, 1 of 12K8, 1 of 12SR7, 1 of 12A6—all metal valves. I.F. value 1415 Kcs. In brand new condition and complete with circuit data. Only 55/-, post paid. Contained in a black crackle case.

Shipping and Top Band. Listeners to these bands will be pleased to know that we can supply a Command Set with a frequency coverage of 1.5-3 Mcs. (100-200 metres). These follow the same specification as the BC455 and are supplied complete with circuit diagram. In brand new condition and contained in black crackle case. Only 39/6.

Receiver Type 159. Valve line-up : 1 of CV66 (grounded grid triode), 1 of EF50, 1 of VR65 (SP61), 1 of VR92 (EA50), small impulse motor, all in case size 8½ x 4½ x 6½in. A real bargain at 12/6, post paid.

Amplifier Unit Type 18/165. A neat and compact equipment incorporating the following valves : 2 of EF36, 1 of EBC33 and 2 of EL32. Also included are microphone transformers, intervalve transformers, numerous condensers and resistors etc. Are you looking for something to "break down"? Then here's your chance. An experimenter's gold mine for only 22/6, post paid.

Blower Motors. For operation from 12 or 24 v. AC/DC but will run from mains when fitted with suitable dropper resistance. Has many uses—ventilation purposes, as a hair dryer, etc. AS NEW. Only 12/6, post free. We also offer a smaller model for operation on 24 v. only at 6/6, post free.

Small 24 v. Motor. AC/DC operation and complete with gear box. Will also work on 12 v. About 140 to 1 double reduction drive, giving very high torque at slow speeds. New condition. Only 12/6, post paid.

Simpson Dual-Range Ohmmeter. BRAND NEW AMERICAN INSTRUMENT. Incorporates 2½in. moving coil meter. Ranges : 0-2000 ohms and 0-200,000 ohms, 52/6, post free.

COMPONENT MART

Dual Crystal Standard. 100 Kcs/1,000 Kcs. As used in Class "D" Wavemeter etc. Brand new and boxed, 25/-, post paid.

Output Transformer. 6 ratios 7/6, plus 6d. post.

Mains Transformers. Standard primarias. Universal mounting. 350-0-350 v. 80 mA., 0-4-6.3 v., 4 a. and 0-4-5 v. 2 a. 250-0-250 v. 80 mA., 0-4-6.3 v., 5 a. and 0-4-5 v. 2 a. 30 v. 2 a. tapped 3 v., 4 v., 5 v., 6 v., 8 v., 9 v., 10 v., 12 v., 15 v., 18 v., 20 v. and 24 v.
All these transformers are brand new, fully guaranteed and priced at 18/6 each plus 9d. post.

Metal Rectifier. 12 v. 2 a. full wave bridge, 12/6, plus 6d. post.

Speakers. 3in. P.M. Brand new 11/9, plus 9d. post. 6½in. P.M. Heavy Duty magnet 9/6. This item callers only.

Potentiometer. Heavy duty twin wire wound pot. 10K and 100K., 5/- each, post free.

Electrolytic Condensers. 8 mfd. 600 v. wkg. 700 v. surge, 3 for 10/-, post paid. 16 mfd. 600 v. wkg. 700 v. surge, 3 for 11/6, post paid. These condensers are tall can type single hole fixing. Minimum quantity which can be supplied by post is definitely three.

FLUORESCENT LIGHTING MANUFACTURERS ! WE HAVE FOR BULK DISPOSAL A LARGE QUANTITY OF 10 MFD. 1000v. D.C. TEST MANSBRIDGE CONDENSERS, SIZE 3½ x 3 x 2ins. ALL BRAND NEW. SAMPLES 3 FOR 10/6, POST PAID. EXPORT ENQUIRIES INVITED

Our stock of valves, C.R. tubes, components and specialised communications and experimenter's equipment is large and varied. Many, many bargains for the personal caller. Why not pay us a visit?

HAVE YOU HEARD OUR NEW RANGE OF HIGH FIDELITY AMPLIFIERS, DESIGNED FOR THE CONNOISSEUR ?

CHARLES BRITAIN (Radio) Ltd.
11, UPPER SAINT MARTIN'S LANE
LONDON, W.C.2 TEM. 0545

3 minutes from Leicester Square Station (up Cranbourn Street)
Shop Hours : 9-6 p.m. (9-1 p.m. Thursday). Open all day Saturday

LAWRENCES
NEW RADAR EQUIPMENT

PROJECTION RADAR INDICATING EQUIPMENT MODEL V.G. TYPE CG-55AEB

Designed and produced by the General Electric Co., U.S.A., for installation in ships, shore stations, aerodromes or research establishments. This Projection Type Plan Position Repeater performs a duty similar to the conventional P.P.I., except that the pattern is optically projected on to a large, flat horizontal surface, instead of being observed directly on a cathode ray tube face. The complete unit is approximately the size of a desk, 35in. high, with the viewing screen occupying half of the top surface, and is operated as a plotting table, on which the actual map-in-motion is portrayed. Navigational calculations are made directly on the paper viewing screen which can be replaced at will from a concealed 30-yard roll supply. The Schmidt Camera and Optical System are of latest design and exceptional quality.

The full screen may be employed to map an area of 4, 10, 20, 80, or 200 miles radius, the choice of range being made by a range selector switch. Electronically generated range marks divide the screen into concentric rings for ranging purposes. In addition, two bearing scales are projected on to the screen, one being fixed to present true or relative bearing, the other rotating to present heading. The radar pattern is therefore far more significant, because it can be observed simultaneously with the pattern of actual bearing.

The equipment is designed for operation with any radar system, of repetition rates of from 60 to 1,000 per second, and only very limited arrangements are necessary to provide the video, trigger and synchro inputs.

BRIEF TECHNICAL SPECIFICATION

Power requirements : 115 v. A.C. Single phase, or 230 v. with auxiliary transformer. Total consumption 1765 watts.

Input requirements : Trigger voltage 5-40 volts peak. Video voltage 3 volts peak max.

Ambient Temperature Limits of Operation : 0°C to +50°C.

Screen Diameter : 25¾in.

Picture Diameter : 24in.

Image Visibility : Image on Projection Screen may be observed in the presence of approx. 1 foot candle of indirect lighting.

Optical System : Highest grade lenses and components by Bausch & Lomb.

Range Accuracy : +1% of total designated range.

Bearing Accuracy : Within .75 degrees.

Overall Dimensions : 59in. x 34in. x 35in.

Weight unpacked : 1,000 lb.

The exceptional quality of construction, together with the numerous operational advantages, are several of many features which make this advanced equipment of outstanding interest in the field of Radar Engineering.

RADAR INDICATING EQUIPMENT MODEL VE. TYPE CAY-55ADV

Manufactured by The Westinghouse Mfg. Co., U.S.A. A Plan Position Indicator Repeater of conventional type employing a seven-inch electro-magnetic cathode ray tube. Instrument is fully enclosed in console type housing.

BRIEF TECHNICAL SPECIFICATION

Power requirements : 115 v. A.C. Single phase, or 230 v. with auxiliary transformer.

Range Calibrations : Electronic, with switched selection of ranges 4, 20, 80, 200 miles radius.

Overall Dimensions : 13in. x 24in. x 26in.

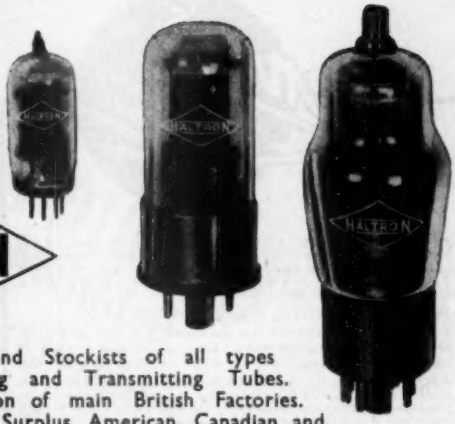
Full technical details of the above equipments available on request.

LAWRENCES, 61 BYROM ST., LIVERPOOL, 3

Phone : CENtral 4430

STRICTLY EXPORT ONLY

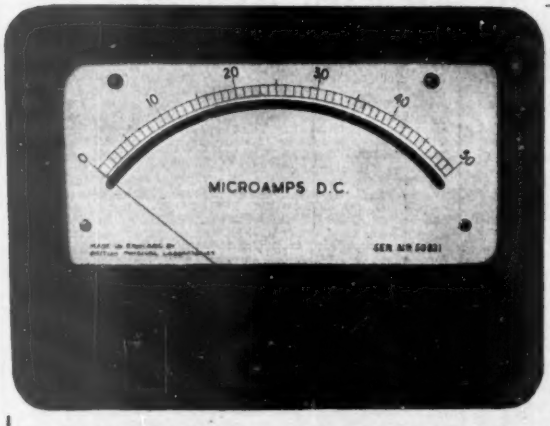
HALTRON



Leading Exporters and Stockists of all types of Radio Receiving and Transmitting Tubes.
Current Production of main British Factories.
Ex-Government Surplus, American, Canadian and British Special Purpose Tubes in Original Brands.
Suppliers to Foreign Governments, Airlines, etc.

HALL ELECTRIC LTD

89, CHARLOTTE ST., LONDON, W.1. Phones: MUSEUM 9661 (5 lines) Cables: HALLECTRIC, LONDON



SIZE	2½"	3½"	5"
RANGE	25μA to 50A	10μA to 50A	10μA to 50A
PRICE			
50μA	62/-	76/-	105/-
200μA	50/-	61/-	95/-
1mA	42/-	54/-	87/-

(Export prices on application)

All sizes available with MIRROR SCALE
1st Grade Accuracy

SENSITIVE PANEL MOUNTING METERS

For particulars of these and our full range of measuring instruments write to :—

BRITISH PHYSICAL LABORATORIES

HOUSEBOAT WORKS · RADLETT · HERTS · Telephone: RADlett 5674-5-6

Henry's
RADIO COMPONENTS
ELECTRONIC & TELEPHONE EQUIPMENT

METAL RECTIFIERS. S.T.C. 300 volts, 75 m/a., 5/- ; S.T.C. 24 volts, 2½ amps. 17/6 ; G.E.C. 6 volts, 1 amp. 4/- ; Westinghouse 12 volts, 2 amp. 12/6 ; Pencil Type E.H.T. 600 v. 1 m.a., 4/7 ; Pencil Type E.H.T. 1,000 v. 1 m.a. 6/- ; Pencil Type E.H.T., 2,400 v. 3 m/a., 15/- ; Pencil Type 350, 500 v., 2 m.a., 7/6.

SM/A METER RECT., 5/- ; W.6. and WX6, 1/6.

5 CPI. C.R. TUBES. Brand new and boxed. 25/-. Carr. paid.

FILAMENT TRANSFORMERS. All inputs 200/50 A.C. 6.3 v. 1.5 amp., 7/6 ; 6.3 v. 2½ amp., 10/- ; 6 v. or 12 v. 3A. 15/- ; 6.3 v. 12A. 37/6.

R.3515 I.F. STRIP. A complete I.F. Unit, comprising 6 SP61 I.F. Stages, tuned to 13.5 Mc/s., 1 EA50 diode detector, and 1 EF35 or EF39 output or video stage. A few modifications only are required to adapt this unit, which will give pictures of extremely good quality. Price, complete with valves, and foolproof modification instructions, is 45/-, plus 5/- carriage and packing. Limited quantity only.

R3547 RECEIVERS. Absolutely brand new, in sealed manufacturers' packing cases. Incorporating 15 valves type EF50, 2 of SP61, EF36, EBC33, 3 of EB34. Complete 45 mc/s. I.F. Strip, motor dial and drive, pots, etc., etc. £6 only, plus 10/- packing and carriage. Whilst they last !

EX-R.A.F. INDICATOR UNIT TYPE 62. Containing VCR 97 CRT with nu-metal screen ; Xtal Unit and valves 1/6/VR65 (SP61), 2/VR54 (EB34), 2/VR92 (EA50), etc., etc., two deck chassis in metal case. 18 x 18½ x 11½in. New condition. 67/6 each. Plus 7/6 packing.

INDICATOR TYPE 6. These units are brand new, in excellent condition, and are all fitted with a VCR97 CRT, the tube which many constructors have put to T.V. use. Valves include 4/VR9 (EF50), 3/VR54 (EB34), plus a host of potentiometers and H.V. condensers, etc. The complete unit is enclosed in a metal box 18 x 8½ x 7½in. **PRICE ONLY £3/19/6** POST PAID. Please include 10/- for transit case to ensure safe transit of unit. Refunded on return of case.

RECEIVER TYPE 21. The receiver portion of the W/S 21 operating from 4.2-7.5 mc/s. Double superhet from 18-30 mc/s. Incorporating B.F.O. and crash limiter. Valve line-up 7-ARP12 (VP23) and 2-AR8 (HL23DD). Absolutely brand new, complete with circuit. Only 45/- complete. Vibrator Power Unit for above, brand new, 17/6 only.

NO. 38 " WALKIE TALKIE " TRANS-RECEIVERS. Complete with Throat Mike, 'Phones, Aerial Rods, Freq. Range : 7.4 to 9 mc/s. Brand new and guaranteed, £4/19/6. Carr. 2/6.

RECEIVER R. 1355 as specified for " Inexpensive Television." Complete with 8 valves VR65, and 1 ea. SU4G, VU120, VR92, and a copy of " Inexpensive T.V." ONLY 55/- (carriage, etc., 7/6).

FREQUENCY CONTROL CRYSTALS. By American G.E. Co. Octal base fixing. Following frequencies only : 2,500 kc/s., 3,500 kc/s., 4,600 kc/s., 6,200 kc/s., 8,000 kc/s., 7/6 each. Also FT243 ½in. pin spacing, 5765KC/7975, 10/- each. 8000/8425KC, 12/6. New and unused.

ELECTROLYTIC OFFER. By leading manufacturers. All metal can 16 x 8 mfd. 500 v.w., can size 3½in. x 1¾in., 3 for 10/-. 32 mfd. 450 v.w. (550 v. Surge) BE37P, can size 4½in. x 1¾in., 3 for 13/6. Also 16 mfd. 500 v.w. size 2in. x 1in., 3 for 7/6, 8 mfd. 500 v.w. type CT850, can size 2½in. x ¾in., 3 for 7/-. Post paid.

MIDGET .0005 mfd. TWO GANG TUNING CONDENSERS. Size only 2½in. x 1½in. x 1¼in. Capacity guaranteed, standard length ¼in. spindle, complete with mounting bracket, less trimmers, 6/6 or, complete with " built-in " trimmers, 7/6 each plus 6d. post.

MAINS TRANSFORMERS. 250-0-250, 90 m/a., 6.3 v. 3 a., 5 v. 2 a., half shrouded, drop through type. Electrostatic screen. Price 15/- only, plus 9d. post. Limited quantity.

I.F. TRANSFORMERS. Manufacturers' surplus. Iron-cored. 465 kc/s. Size 4in. x 1½in. x 1¼in. Per pair 8/6 whilst they last.

TYPE 25 R.F. UNIT, brand new, converted from new R.F.24. 19/6. (Carriage and packing 1/6.

R.F. UNIT TYPE 24. For 26-30 mc/s. Preset, switched tuning, incorporating 3 valves SP61. Brand new, ONLY 16/6. This unit can now also be supplied modified to cover R.F. 26 frequency (for Midlands T.V.), brand new, at 25/-.

Send stamp for current Component List—
Probably the most comprehensive in the trade

5, HARROW ROAD, LONDON, W.2
PADdington 1008/9 and 0401

1 KW TELEGRAPH TRANSMITTERS. Two HF 300's output. Operation 3.5 mc to 16 mc.

HALLICRAFTERS BC 610's. Complete with speech amplifier, antenna tuning unit ; exciter units and coils for all bands.

RCA TRANSMITTERS. Type ET-4336. Complete with matched speech amplifier, crystal multiplier and VFO units. Brand new.

LM-300 TRANSMITTERS. (U.S.A.). 140 kc to 400 kc and 650 kc to 1,600 kc. 300 Watt output.

No. 12 TRANSMITTERS. With coupling units, remote control etc.

AUTOMATIC HIGH SPEED TELEGRAPH EQUIPMENT. " BOEHME " (U.S.A.). Up to 400 signs per minute on line and wireless.

NAVY MODEL TBY-8 TRANSMITTING - RECEIVING EQUIPMENT. Output 0.75 watts on M.C.W. telegraphy and 0.5 watts on telephony. Frequency range 28-80 mc.

SKYRIDER DIVERSITY HALLICRAFTERS RECEIVERS. Complete with console, power units and loudspeaker.

All above items in excellent working condition.
Working demonstration upon request.

TX VALVES 805, 807, 813, 814, 832, 861, 866A, DET-16 ; 6L6 Met. and many others.

Large stock of Tx condensers, crystals and other components. Alignment and repair of communication receivers and all other short-wave equipment undertaken.

P.C.A. RADIO

Transmitter Division :—
The Arches, Cambridge Grove, London, W.6. *Tel. RIV 3277*

Receiver Division :—
170 Goldhawk Road, London, W.12. *Tel. SHE 4946*

MIDLAND INSTRUMENT CO.

FOR GOVT. SURPLUS STOCK, ETC.

MAINS TRANSFORMERS, input 200-220-240 v. 1-phase 50-cycles tapped output giving 3-4-5-6-8-9-10-12-15-18-20-24-30 v. at 2 amps., brand new, boxed with all termination data, a superior transformer with 101 uses, 20/-, post 1/3. **RECTIFIERS,** selenium full-wave, A.C. input 15 v., D.C. output 12 v. 2 amps., suitable for use with above transformers to charge a 2-6 or 12 v. battery, new unused 15/-, post 7d. **TOGGLE SWITCHES** REF-5D/531, 250 v. 2 amp., single hole panel mounting, s.p.c.o. or on/off, new, boxed 9d., post 3d., 7/6 doz., post 6d., 72/- gross, post 1/6. **MOVING COIL HEADPHONES,** to which is attached a moving coil microphone, hand type fitted switch, bargain 7/6, post 10d. **MICRO SWITCHES,** make and break, 2/6, post 3d. **MOTOR GENERATORS TYPE 72,** can be converted in a few minutes to an efficient 200/250 v. A.C. mains motor, suitable for sewing machines, etc., etc., fitted 3/16in. shaft, ball-bearing, standard base mounting, new unused complete with conversion data, 15/-, post 1/6, brass v-pulleys specially turned for above motors, 2/6 extra. **BLOWER MOTORS,** 24 v. A.C./D.C., or down to 12 v. at less effect, new unused 7/6, post 1/-. **MODULATOR UNITS, TYPE 169,** contains CV-67 Klystron, 5U4G, EF50, 3 neon stabilizers, also B4101 valve, two 250 v. 100 m/A. selenium rectifiers, small motor with reduction gearing, 2 large transformers, various oil and paper condensers, pots., resistors and other incidentals, in metal cases, size 18in. x 8½in. x 7½in., brand new in wood cases, special offer 37/6, carriage 7/6. **MOTOR ALTERNATORS,** consists of 230 v. 50 cycle 1 phase .64 amp. cont. rating 2,880 r.p.m. capacitor motor, fitted enclosed reduction drive gearbox, final drive approx. 60 r.p.m., motor is coupled to alternator, 250 v. 1,250 cycles .24 amp., flexcitation 24 v. .4 amp. cont. rating, size approx. 14½in. long 6in. dia., standard motor base, external wiring diagram inside termination cover plates, perfect condition, £3/10/-, carriage 7/6. **HEADPHONES L.R.,** new boxed 5/-, post 8d. **VEEDER COUNTERS,** 0-9999, plated case enclosed, ¼ dia. side shafts, 5/-, post 3d. **TELEPHONE SETS,** consists of 2 combined telephones and microphones, 100ft. P.V.C. covered telephone connecting wire, provides perfect 2-way communication, self energised (sound power), no battery required, new boxed, 7/6, post 8d., ditto with 100 yds. connecting wire, 10/-, post 1/-. **SPECIAL OFFER** of 100 yd. coils single conductor 250 v. insulation T.R.S. cables (mostly C.M.A.), all new clean perfect stock at far below current wholesale prices :— 1/044 30/-, post 1/6 ; 3/029 35/-, post 1/6 ; 3/036 40/-, carr. 2/- ; 7/029 45/-, carr. 2/6 ; 7/036 55/-, carr. 3/- ; 7/044 65/-, carr. 3/6 ; 7/052 75/-, carr. 4/-, also twin circular 16/012 T.R.S. flexible, 50/-, post 1/6.
Send for our new 20-page lists, include many new items.

MOORPOOL CIRCLE, BIRMINGHAM, 17.
Tel. : HARborne 1308 or 2664

Recognised as the Most Reliable Valveholders

Now in full production
NOVAL and B7G
Valveholders
of all types in
NYLON LOADED BAKELITE

B9A—NOVAL

B 7 G

We make all types of Valveholders

THE McMURDO INSTRUMENT CO., LTD., VICTORIA WORKS, ASHTEAD, SURREY · ASHTEAD 3401

Remember McCarthy?

A NAME WHICH HAS ALWAYS MEANT EFFICIENCY TO THE TECHNICIAN, TROUBLE-FREE EQUIPMENT TO THE DEALER, AND RELIABILITY TO THE DISCRIMINATING PUBLIC—BACK AGAIN WITH THIS 9" TUBE T.V. CHASSIS

COMPLETE · WIRED, ALIGNED, TESTED AND READY FOR USE

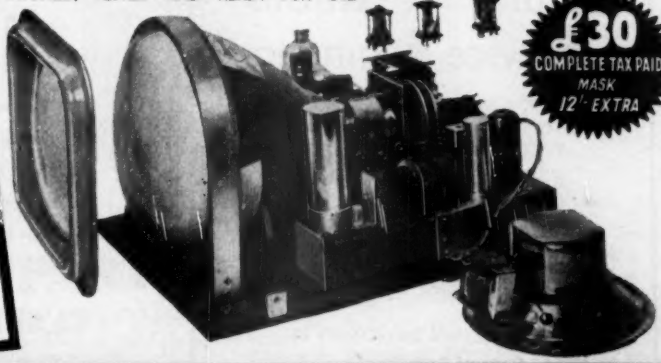
LINE FLY-BACK E.H.T. WITH EFFICIENCY DIODE BOOST GIVING 6½ K. VOLTS.

PERMANENT MAGNET FOCUSING

PLUG-IN COILS FOR ALEXANDRA PALACE, SUTTON COLDFIELD, OR HOLME MOSS — PLEASE STATE FREQUENCY WHEN ORDERING

CIRCUIT DETAILS

Superhet receiver—Three miniature valves common to sound and vision—Anode bend detectors for sound and vision—Blocking oscillator frame time base—Self-oscillating line output valve with efficiency diode.



£30
COMPLETE TAX PAID
MASK 12/- EXTRA

McCARTHY RADIO · STUDLAND ST., HAMMERSMITH, LONDON, W.6. *Phone: RIVerside 2597-5647*

R.C.A. TRANSMITTER
ET4336 COMPLETE

NEW AIR TESTED

Available in quantity for export.

SPECIAL TERMS TO LICENSED AMATEURS.

FREQ. METERS BC 221
few still available.

TRANSMITTING TUBES — ALL TYPES.

SQR 522, VHF Trans/Rec.

BC 375E TUNING UNITS
New with cases, TU 7/8/9/10 and 26B. 12/6 each, + 2/- carriage. TU 5 and 6, 22/- each, + 2/- carriage.

IDEAL 25 WATT TRANSMITTER
Army Type No. 12, Frequency Coverage 1.2 to 17.5 mc/s, in Four Switched Bands. C.W. and Phone, Built-in Modulator, A.C. Mains, 100 Volt or 250 Volt, Complete with all Tubes and Delivered. £18.

Send for details of our compact EX/TX F-U-40. 40 watts.

HALLICRAFTER U.K. AGENTS

McELROY-ADAMS MFG. GROUP LTD.
46 GREYHOUND ROAD, LONDON, W.6.
Cables: Hallicraft, London. Phone: FULham 1802.

ASSOCIATED ILIFFE TECHNICAL BOOKS

WIRELESS SERVICING MANUAL
By W. T. Cocking, M.I.E.E. (8th Edition). Deals with the location and cure of the innumerable faults which can develop in broadcast receivers and their allocated equipment. Domestic sets, short-wave receivers and converters are covered, and there is a special chapter on servicing with the cathode-ray oscilloscope. *12s. 6d. net. By post 12s. 11d.*

RADIO DATA CHARTS: 43 Abacs for Receiver Design Calculations
By R. T. Beatty, M.A., B.E., D.Sc. Revised by J. McG. Sowerby, B.A., M.I.E.E. This fifth edition covers the most frequently recurring problems, the answers to which provide most of the data required for the design of radio receivers.
7s. 6d. net. By post 7s. 11d.

TELEVISION RECEIVING EQUIPMENT
By W. T. Cocking, M.I.E.E. (3rd Edition). Explains the fundamentals of the subject and deals with practical details of receiver design. There is a lucid description of each stage of the normal television receiver, as well as detailed attention to special circuits.
18s. net. By post 18s. 8d.

Iliffe Technical Books are obtainable at all booksellers or direct from the address below. Write for the complete Radio Book List.

DORSET HOUSE, STAMFORD ST., LONDON, S.E.1

SERVICE ENGINEERS!

Do YOU know that the

Guild of Radio Service Engineers

is the accepted Organisation representing Radio and Television Service Technicians ?

It is recognised by the employers' and other Trade Organisations, and by the appropriate Government Departments, as the representative body for the Service side of the Trade.

Write for full particulars to:

H. HILL, General Secretary,
2, Stevenson Street West,
Accrington, Lancs.

Any Voltage regulation problems?

Do power cuts upset your production?

A Variac infinitely variable voltage regulating transformer will probably solve your problem. Write for 32 page Catalogue V549 which gives full details of the Variac transformers and their manifold applications.

CLAUDE LYONS LTD

180 Tottenham Court Road, London, W.1. *Tel: MUSeum 3023/6*
and 76 Oldhall Street, Liverpool 3, Lancs.

Wireless World Classified Advertisements

Rate 7/- for 2 lines or less and 3/6 for every additional line or part thereof, average lines 8 words. Box Numbers 2 words plus 1/-. (Address replies: Box 0000 c/o "Wireless World," Dorset House, Stamford St., London, S.E.1.). Trade discount details available on application. Press Day: June 1951 issue, Wednesday May 2nd. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components which may be offered for sale through our columns carry no manufacturers' guarantee. Many of these components will have been designed for special purposes making them unsuitable for civilian use, or may have deteriorated as a result of the conditions under which they have been stored. We cannot undertake to deal with any complaints regarding any such components purchased.

SPECIAL NOTICE

Advertisers please note.—With effect from the June issue of Wireless World, Classified Advertisement Rates will be 7/- for 2 lines or less and 3/6 for every additional line or part thereof.

NEW RECEIVERS AND AMPLIFIERS

UNIVERSAL ELECTRONIC PRODUCTS, 36, Mary-le-bone High St., London, W.1. Welbeck 4056.

SPECIALISTS in the design and manufacture of high fidelity reproducing equipment from 5-100 watts for domestic or industrial purposes. Our new twin channel amplifier (type U.E.57), with independent bass and treble outputs, provides the most satisfying standard of reproduction we have yet experienced. It is now being demonstrated in our showrooms daily (we close Thursday 1 p.m., Saturday 4.30 p.m.), and we invite those who seek perfection from recorded music to hear this superb instrument. We also offer tuning units or complete chassis designed and constructed to individual requirements. [6802

9 KC Rejector, effectively removes the 9kcs whistle, rejection at 9kcs better than 35 DB; price 65/- each; response curve on application.

ROGERS DEVELOPMENTS Co. (M.O. Dept.), 116, Blackheath Rd., S.E.10. [6802

12-watt high quality amplifiers, bass and treble boost; £12/10; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0068

WILLIAMSON amplifier from £15/10; also an equivalent in performance Universal amplifier; for details and demonstration, write or 'phone A. S. Colman, 1, St. Stephens Gardens, W.2. Bay. 3661. [6789

CHARLES AMPLIFIERS, Ltd., are now able to produce amplifiers, radio units and electronic equipment to specification; enquiries invited for development work and for short production runs.—Charles Amplifiers, Ltd., 40, Kensal Rd., W.10. [0173

MIDLAND RADIO COIL PRODUCTS offer a service for the production of high quality amplifiers and radio equipment to specification: list of standard products is available; suppliers of audio and radio equipment to the Northamptonshire Education Authority.—Enquiries to 28, Winstanly Rd., Wellingborough. [6336

C.J.R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd., Hubert St., Birmingham, 6 (Aston Cross 2440). The Midlands specialist manufacturers of high fidelity sound reproduction equipment, for the world-famous Williamson amplifier and associated accessories including tone control stages, loudspeaker crossover units, distortionless contrast expanders and radio feeders; send for details and prices. [0105

OUTSTANDING value in radio to-day, our SL.35 three wave-band 5-valve superhet. radiogram chassis is, we believe, the best value for money obtainable anywhere: large, fully illuminated glass dial in pleasing colours, fully aligned and tested, ready for installation at 12-8-0 with 8in P.M. speaker or 12-18-0 with 10in P.M.; the all round performance of this model is truly remarkable; 2½d stamp for illustrated leaflets; trade enquiries invited.—Bayly Bros., 46, Pavilion Drive, Leigh-on-Sea, Essex. [6500

TELRAD ELECTRONICS, 70, Church Rd., Upper Norwood, London, S.E.19.—Designers and manufacturers of Telrad quality amplifiers; established as the most outstanding value in high-quality amplifiers, thanks to faithful reproduction at unrivalled price, these unique amplifiers are the first choice of the enthusiast; built to satisfy the discriminating ear; bass and treble independent controls, providing widest possible variation to suit all recordings and varying acoustic properties of one room with another; £18 complete; full details on request.—Write, call or 'phone Livingstone 4879. [0019

Partridge News

Pointers to PARTRIDGE PRECISION TRANSFORMER SERVICE

- "Standard" and "to Specification" types available in over 100 Models in 5VA to 100kVA range.
- Delivery in EIGHT WEEKS—or less according to type.
- Wide Range of hermetically sealed types including the new inter-service approved type 'C' Admiralty type (as illustrated).
- ALL WILLIAMSON Amplifier components immediately available from stock.
- An advisory and design service for the production of "to Specification" types—this specialist facility is used by the B.B.C., the Post Office, Government Research Stations, and leading Industrial Concerns.

PARTRIDGE TRANSFORMERS LTD
ROEBUCK ROAD, KINGSTON BY-PASS
TOLWORTH SURREY
Telephone: ELMbridge 6737-8

NEW RECEIVERS AND AMPLIFIERS

PX25 push-pull amplifiers, steel cabinet, panel meter, may be rack mounted; A.C. mains, brand new, £10 complete; G.E.C. 10-valve, 5 waveband radiogram chassis, 10-2,000 metres, separate bass and treble controls, push-pull 10 watts output, guaranteed 5 months; offered below list price, £25.A.C./D.C. amplifiers, tape recorders, etc.—Autospares, 100, High St., S.W.17. Balham 5596. [6767

CONNOISSEUR'S receiver, acclaimed by its users as the finest receiver for the enthusiast and the only one with the following facilities: 9-1,500-metre, world-wide results on highly sensitive 10-valve receiver, comparable with any good communication set, or by change of switch, maximum fidelity reception of local stations on non-superhet receiver with high quality 2-PX4 push-pull amplifier incorporating full refinements, bass and treble tone control (boost to cut), whistle filter and gram input, etc.; basis rebuilt R1155; write for details or call for demonstration. FEEDER units as above, for use with external high-quality amplifiers; R1155 specialists, receivers repaired and re-aligned, also modified as above, or to your requirements; R1155 circuit and values 2/- post free.—R.T.S., Ltd., 5, Gladstone Rd. Wimbledon, S.W.19. Tel. Lib. 3303.

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

R1155 receivers, modified, include power-pack and output; £11.—Box 0638. [6736

R1155 with power pack, push-pull output and speaker; £11.—Box 0759. [6797

HALLICRAFTER S38, 4 bands (3 short), service chart; £12.—Wilton, 17, Brunswick Pl., Stoke, Plymouth. [6708

R1155 receiver complete with power-pack, as new, requiring only speaker to operate from A.C. mains; offers £17/10.—Box 0635. [6730

HALLICRAFTER BC614 speech amplifiers complete all tubes, perfect condition; £18. BENDIX BC221 frequency meters, complete, perfect; £25.

SCR 522 freq. 100-156 mcs. complete transmitter/receiver in new condition with all tubes; £30.

TUNING units, types TU6 to TU26B, new with covers, 12/6; BC610 tuning units, P.A. coils and spares available. WS19 Mk II and installation kits, spares, etc., large quantities.

EXPORT enquiries for ex-Govt. American spares promptly attended.

McELROY ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1802. Cables, Hallicraft, London. [0194

70-500 m/cs superhets, 5 valves, new Admiralty miniature receiver, unique circuit; £2 each.—Autospares, 100, High St., S.W.17. Balham 5596. [6768

HRO Rx's and coils in stock, also AR88, BC348R, CR100, etc.—Requirements please to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986 [0053

AR88 perfect condition and alignment, c/w manual, speaker, spare valves, transit case, £65; accept B/C receiver part exchange.—606, King Lane, Alwoodley, Leeds. [6798

NEW LOUDSPEAKERS

BARKER 150, £18/18; model 148A, £15/15; Goodmans Axiom 22, £12/13; Axiom 150, £8/8; Wharfedale Super 12/CS/AL, £14; W10/CS or CSB, £8/10; Golden, £4/17/6; Golden CSB, £4/17/6; Super 8, £3/17/6; 8CS, £4/12/6; CS/AL, £4/12/6. WB Concentric Duplex, with O.T., £7/7; without O.T., £6/6; high grate Bass Reflex and Corner loudspeaker cabinets, illustrated leaflet on request; all speakers post free.

ROGERS DEVELOPMENTS Co. (M.O. Dept.), 116, Blackheath Rd., S.E.10. [6801

LOUDSPEAKERS—SURPLUS AND SECONDHAND

TWO Goodmans Axiom 12, £6 each or nearest offer.—Box 0629. [6714

BARKER 1461n corner cabinet; £15.—4, Baldwyns Park, Bexley. [6790

REFLEX cabinet for sale, specially made by E.L.R., size 32×16×16, 12in speaker; £4/15.—Moss, 229, Strand, W.C.2. [6772

VOIGT H.C. horn, walnut finish, with Super 8 speaker; £12.—15, Glover Rd., Pinner, Pin. 931. 6758

NEW TEST EQUIPMENT

COSSOR double beam 3339 oscillographs, in good order, from £50, or exchange what have you.—Cox Radio 39, West St., Bognor Regis. [6539

TEST EQUIPMENT—SURPLUS AND SECONDHAND

MOVING coil D.C. meters, 0-3,500, 3½in dial 35/-; also 2in F.S.D. 1.5ma, scaled 0-5 6/-.—Paxolingham, 16, Greenhead Lane, Keighley. [0092

NAGARD type 1028 oscilloscopes, reconditioned by makers, 5in C.R.T.s, few left only, useful response to 5 mc/s, calibrated voltage and frequency; £36 each.—Nazard, 245, Brixton Rd., S.W.9. [6783

SIGNAL generators, oscilloscopes output meters, valve voltmeters, frequency meters, multi-range meters in stock; your enquiries are invited.—Requirements to R.T. & I. Service, 254 Grove Green Rd., London, E.11. Ley. 4986.

THE IDEA BEHIND THE WORDS HARTLEY-TURNER

2. Living up to an Ideal

We have stressed quality and service in our dealings with you. These are directed towards our one and only "commodity"—what is now usually called high-fidelity sound reproduction. When we started business this ticket had not been thought of, for in those days the only sound reproduction was so far removed from real life as not to be seriously considered as a means for æsthetic enjoyment. If we were considered pioneers of high-fidelity, it was only because we were the first to produce equipment that had serious claims to be considered as producing sounds which did approximate to reality.

Our first product was a speaker, and it was better than the newly introduced moving-coil speaker to the same extent that the latter was better than what had gone before. The moving-coil speaker hinted at the great advance that could be made in sound reproducers; the Hartley-Turner realised it.

We found that a high-fidelity speaker could not be made by mass-production methods. We do not deny that mass-production can achieve miracles of mass-precision, but it was in the nature of things that a speaker very free from distortion must be made in a way which does not lend itself to mass-production. Nothing would have pleased us better than to devise a way of making such a speaker cheaply and in large quantities; but over twenty years later the problem is still unsolved.

Quite early in our existence we had, therefore, to face up to a matter of major policy; should we stick to the hand-made high-grade product, or should we design something for the mass market? Or should we try and break into both markets? We decided that we would stick to high-fidelity and nothing else. We fixed our ideal as making a perfect speaker or rather, as near perfect as we knew how. And we have lived up to that ideal ever since.

We have never had a "range" of models. We do not make speakers with a range of impedances or a range of diameters. We have only one model; we have always had only one model—the best we can make. In our time we have tried duplex speakers, twin-cone speakers, duode voice-coil speakers, and so on. All these were interim attempts to make the perfect speaker, and we are still short of the goal. But what we have in the 215 is a speaker which faithfully maintains our original aim. It is the best speaker we can make, and the best that we can make is very acceptable to most people.

It is still hand-made. It has to be. Its price is £10 . 10 . 0. It could have been less if we had solved the problem of mass-producing such a speaker. It could have been very much more if we had worked on some other lines of development; but it happens to be £10 . 10 . 0. It also happens to be 10in. in diameter, and it also happens to have an impedance of 4 ohms. We say "happens" because the 215 is the outcome of thousands of experiments over more than twenty years directed towards perfecting the design. And what has emerged "happened" to be the best.

We apologise for our catalogue having run out of print, but the demand has been far beyond all expectations. A new edition is being got ready as fast as possible, so just send a postcard saying you would like one. It is worth waiting for.

Our renowned high-fidelity guide "New Notes in Radio" (5th edition) is still available at 2s. 6d.

H. A. HARTLEY Co. Ltd.

102, HAMMERSMITH ROAD, LONDON, W.6

RIV. 7387

NEW DYNAMOS, MOTORS, ETC.

BATTERY chargers, 4 models, 2-6-12v, 1-2-4 amp D.C.; any mains voltage; also larger types special transformers, chokes, test gear, interior car heaters, etc.—The Banner Electric Co., Ltd., Hoddesdon, Herts. [0122

ALL types of rotating electrical machinery up to 20kva available, including rotary converters, rotary transformers, motors, petrol and diesel-engined generating plants, alternators and d.c. generators. We are also in a position to quote for power transformers; as actual manufacturers we will be glad to quote for any quantity for home or export.

DIESEL Electric generating plants, 3kva, 230v with push-button remote control, starting equipment ready for use, £205.

ROTARY transformers, input 20v d.c., outputs 6.5v d.c. and 300v d.c., permanent magnet field, 20/-; ditto, input 28v d.c. and 1,200v 70ma d.c. output; energised field, 35/-; ditto, input 12v d.c., output 500v, 90ma d.c., energised fields, 35/-.

PETROL electric generator plants, comprising a J.A.P. No. 2a single cyl. engine coupled by vee rope drive to an alternator, giving an output of 250v 50 cycles, 400 v.a., with screened ignition and filtering on generator, eminently suitable for operating television and radio on farms, etc., price £40; such plants can be supplied with various outputs, a.c. or d.c. for other applications.

CHAS. F. WARD, Lordsveit Works, Haverhill, Suffolk. Tel. 253. [0059

DYNAMOS, MOTORS, ETC.—SURPLUS AND SECONDHAND

CHARGING and lighting plants, a.c. and d.c.; please state terms; 1, 2 and 3 are not surplus, but current products of well-known British manufacturers.

ALTERNATOR, 230.1/50, 3 kVA, belt driven by Petters very latest type diesel engine A.V.1; self-energised automatic voltage control, handle starter and press button, also remote control, one press button remote control start and stop supplied; extra control units, £1; complete with h-duty starter battery and battery charger, full load 5 hrs on 1 gall of fuel; engine covered by Petters inspection service; tested on full load before dispatch; delivered ready for use; £205.

230/1/50 Alternators, 400 va. with voltage regulator, self-energised, clock or anti-clock, 3,000 rpm, suitable television; £18 del.

ALTERNATOR, 230/1/50, 3 and 6 kva, 1,500 rpm, self-energised with voltage control winding, 24v charging and lighting winding, press button start, 6v batts car type, 72 amp-hr, 65/-, wooden cased 85 amp-hr 70/-, 120-140 amp-hr 100/-, 6 for £19 del.

PLEASE do not ask for catalogues, state exactly your requirements; see displayed advert page 92 for S.T.C. selenium rectifiers; terms c.w.o., proforma invoice, c.o.d. (post goods only).

PEARCE, 66, Great Percy St. W.C.1 (near Angel). [0014

TRANSMITTING EQUIPMENT

TR1143A sets in good condition, quantity available for disposal cheap.—B.E.R., 69, Church Rd., Moseley, Birmingham. [6792

NEW GRAMOPHONE AND SOUND EQUIPMENT

FRITH RADIOCRAFT, Ltd., offer from stock:—

ACOS GP-20 pick-ups with standard head, £3/11/5; extra microgroove heads GP-19LP, £2/3/4.

MARCONI type 14 pick-ups, Hi-Fi lightweight for miniature needles, complete with matching transformer, £2/8/4; complete with matching former, £1/15/10.

B.S.R. MU-10 gram motors, 2-speed, turnover pulley for 33 or 78 rpm, £5/15.

B.S.R. MU-14 de luxe version of above, fitted with instant speed change, 33-45-78 rpm, £5/19/4.

COLLARO AC-514 radiogram units complete with magnetic pick-up, £6/10/5.

ALL above prices include purchase tax; post free in United Kingdom.

EXPORT orders tax free; price list by air mail on request.

FRITH RADIOCRAFT, Ltd., 69-71, Churchgate, Leicester. 'Phone 58927. [0024

TAPE recorder motors, 230v a.c., powerful, quiet, brand new, 13/11; post, etc., 1/1.—K. W. Logan, Westalley, Hitchin, Herts. [6469

WILLIAMSON amplifier, coils to specn., L/W or MW, 7/6 pair, or 9/- your stns.; chassis for above, 18/6; s'het tuner coils, all bands, 2/6 each.

TRANSFORMERS, Battleship series heavy duty, steel framed, 1 yr. guarantee, 6v6, 6L6 push-pull, split PRI and SEC, results exc., HF response, ample core ensures LF, only 22/9; smaller, single ended, 9/9 (3 and 5 watt amplifier); ditto, smaller wire ended, bargain at 5/6; 6.3v @1.5a heater, 9/-; 0.2 4.5 6.3v 4a, best value for money, 20/-; Williamson mains Tx and choke, 78/6 pair; 1K, 2K, 150K, 2M resistance pots, 5/10; HF horn metalwork; trade supplied.

BEL SOUND PRODUCTS Co., Marlborough Yard, London, N.19. Archway 5078. [0187

MAGNETIC Tape.—Emitape on 1,200ft spool, 25/-; G.E.C. 1,200ft 30/-; blank recording discs, 10in d/sided, 3/-; all from stock; full trade terms available.

SOUND DISCS (SUPPLIES), Ltd., 178, Bispham Rd., Southport, Lancs. Tel. 58153. [5335

TAPE recorders from stock, £20; amplifiers, 10-valve radiogram chassis and recording playback by G.E.C., £30.—Autospares, 180, High St., S.W.19. Balham 3056. [6769

INFINITE baffle corner deflectors, scientifically designed acoustic chambers for 8 to 15in speakers; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0064

NEW S.T.C. SELENIUM RECTIFIERS. Largest L.T. range in Great Britain. Current products. NOT SURPLUS. E.H.T. H4/200 W.W. Televisor replaced by N2/100, 17/-; for VR97, N2/50 12/-. Post 6d.

Note Increased Prices from 1st Jan. 1951.

HALF WAVE RECTIFIERS.

16v. ½a., 7/6; 1a. 9/3; 2a. 10/8; 3a. 17/6; all post 6d. 4a. 18/-; 6a., 23/9; post 10d. 30v. 1a., 13/6; 2a., 15/10; 4a., 28/-; 6a., 41/6; 48v. 1a., 17/10; 2a., 21/3; 4a., 40/6; 6a., 58/-; 100v. 2a., 39/6; 4a. 74/-; 6a., 108/-; all P. 1/-.

HALF WAVE HEAVY DUTY 7½in. SQUARE COOLING FINS.

16v. 5a., 24/3; 10a., 26/-; 20a., 48/6; 30v. 5a., 39/6; 8a., 43/6; 48v. 2.5a., 29/6; 5a., 54/3; 8a., 61/-; all post 1/-.

BRIDGE CONNECTED FULL WAVE.

17v. 1.25a., 13/9; 1.7a., 17/7; 2.5 a., 22/9; 3a., 24/9; 4a., 28/-; 5a., 29/6; all post free. 33v. ½a., 21/-; 1a., 24/3; 1.5a., 32/-; 2a., 35/-; 3a., 40/4; 4a., 48/-; 5a., 50/-; all post 10d. 54v., 1.5a., 44/-; 2a., 54/-; 3a., 61/-; 5a., 75/-; 72v., 1.5a., 57/-; 2a., 69/-; 5a., 93/-; 100v. 1.5a., 82/-; 2a., 100/-; 5a., 144/-; all P. 1/-.

BRIDGE CONNECTED HEAVY DUTY 7½in. SQUARE COOLING FINS.

17v. 6a., 38/10; 10a., 47/6; 12a., 82/-; 20a., 90/-; 33v., 6a., 73/-; 10a., 81/-; 12a., 142/-; 20a., 160/-; 54v. 6a., 102/-; 10a., 114/-; 72v. 6a., 132/-; 10a., 148/-; 100v. 10a., 215/-; all P. 1/6.

BRIDGE INDUSTRIAL FUNNEL COOLED. 17v. 12a., 86/-; 20a., 99/-; 30a., 140/-; 50a., 212/6; 33v. 6a., 79/-; 10a., 90/-; 12a., 142/-; 20a., 164/-; 54v. 6a., 104/-; 10a., 122/-; 72v. 6a., 130/-; 10a., 154/-; 100v. 6a., 180/-; 10a., 217/6; all post 1/6.

VALVE CHARGER REPLACEMENTS. Send Circuits, max. A.C. voltages marked and max. No. 2v. cells chargeable, for reply.

Wholesale & Retail

T. W. PEARCE (Est. 19 yrs.)

66 GREAT PERCY STREET, LONDON, W.C.1

Off Pentonville Rd. Between King's Cross and Angel

SELENIUM H.T. & L.T. RECTIFIERS, CHARGER KITS, CHARGERS

New Goods with Full Guarantee

CHARGER KITS. Standard 2 v., 6 v., 12 v. kit comprises 12 v. 2 amp. selenium rectifier, 45 watt impregnated transformer, ballast bulb, no rheo or ammeter needed, dead reliable and foolproof **38/6**, post 1/6. Or with handsome steel case as illus., **52/-**. Heavy duty 3 amp. kit for 2 v., 6 v., 12 v., 12 v. 4 amp. S.T.C. rectifier, 70 watt transformer, ballast bulb, wt. 9lb. **52/6**, post 1/6. Ditto but for 6 v. only **46/6**. Special steel case, screws, grommets **17/-**. 4 amp. kit as above for 6 v., 12 v., 11lb., less case, **58/6**. Minor Kits. 2 v., 6 v., 12 v. 1 amp. **32/6**, post 1/3. 6 v. ½ amp. for 230 v./250 v. only **18/9**, post 1/2. 6 v. 1 amp. **26/-**. Transformer and rectifier for 2 v. ½ amp. trickle charger, **12/6**, post 6d.

"**AUTOMAT**" Car or Radio chargers, as illus., virtually unwreckable and ultra reliable, as tested by motoring press 6 v./12 v. 1 amp. **52/6**; 2 amp. **59/6**. Wt. 8½ lb. Carr. 2/-. 5 amp. model, 16lb. **£5/19/6**. Carr. 3/-. 12 months' guarantee.

SMALL SPACE H.T. RECTS., for A.C./D.C. sets etc., new, wrapped in maker's wrappings, 250 v.60 ma. **7/-**, post 6d. 130 v. 60 ma for U.S.A. midgets, **6/6**; 130 v. 40 ma **5/-**. 90 v. 40 ma bias. type **3/-**; 250 v. 100 ma. bridge **14/-**. 350-0-350 v. 80 ma **15/6**.

S.T.C. SELENIUM RECTIFIERS, new stock, 2 v./6 v. ½ amp. **4/10**; 6 v. 2 amp. **9/-**; 6 v. 4 amp. **16/-**; 6 v. 10 amp. **22/6**; 12/16 v. 1 amp. **12/6**; 12/15 v. 2 amp. h.w. **18/-**; bridge **15/-**; 12/15 v. 4 amp. **23/-**; 4.5 amp. **26/-**; 6 amp. **35/-**; 18 v. 4 amp. **27/6**.

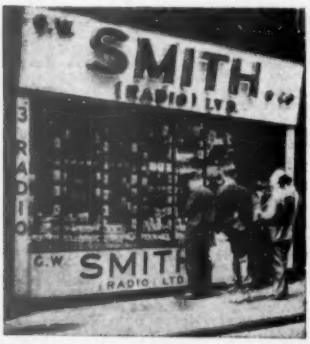
ELIMINATOR KIT, for 120 v. 20/30 ma. with trickle charge, 22 watt trans. layer wund, 30 ma. h.t. rectifier, 2 v. ½ amp. trickle rect., 2 x 15 mfds condensers, handsome steel case, **42/-**, post 1/2, less case **26/-**.

HEAVY DUTY CHARGER KITS. S.T.C. 12 v. 6 amp., giant finned rectifier 120 watt trans., ammeter, worm drive slider res. for 6 v., 12 v./6 amp., 16lb. **24/7/-**, post 2 parcels, **2/6**. Ditto but 4 amp. **23/17/-**. Ditto, but for 18 v. 4 amp. d.c. output, charges up to 18 cells at 2 amps, **£4/15/-**.

"**RENEWHAT**" battery desulphater and conditioner, radio **1/9**; car size **3/-**, post 6d.

CHAMPION PRODUCTS

43 Uplands Way, London, N.21. Phone LAB 4457



A WINDOW WORTH LOOKING INTO

Meters. 2in. round 0-500 microamp movement, 7/- each ; Indicator Units, type 217a, containing 0-100 microamp movements, 39/6 each ; 2in. round 0-1½ mA, 7/6 each.

Transformers. Special offer ex-W.D. 230 volt input 50 cycle, output 4 volt 8 amps., 6.3 volt 1 amp C.T., 12/6 each ; E.H.T. transformers, ex-W.D., 230 volt 50 cycle input, 1800 volt 20 mA output, 19/6 each.

Rectifiers. 12 volt 5 amp Full Wave, 17/6 each ; 24 volt 5 amp Full Wave, 32/6 each ; 850 volt 40 mA, 8/6 each ; 2 volt ½ amp, 2/6 each ; 48 volt 60 mA, 2/6 each ; 12 volt 1 amp, 10/6 each.

Television. Amplifiers, type 208a, complete with 2 E.F. 50's for 45 Mc/s or sound complete with mod. circuit, 13/6 each.

Television. Ditto, single stage, less valve, 4/6 each.

Output Meters. American type CWI-60ASJ, complete with 0-50 2½in. microamp meter, 72/6 each.

Ground Station. Remote control, complete with type D morse key, brand new, 10/6 each.

American type, 58 Transmitter-Receiver. Slightly gashed but complete with 100 Kc. crystal, 19/6 each. Very limited number only, special Hams' Treat.

Switches. 2 bank single pole 8 way, 1/9 each ; 1in. single pole 7 way, 1/3 each ; heavy duty 2 pole 6 way, will pass 10 amps 250 volt A.C., 5/6 each ; 1in. 3 pole 4 way, 9d. each.

Telescopic Aerials. 15in.-7 foot in Dural, ideal for television aerials, 5/6 each.

Television. Power packs, ex-W.D., type 285, complete television power supply. Input voltage 230 volt 50 cycle, output 350 x 350 volt 200 mA, 6.3 volt 15 amps E.H.T. supply, 2500 volt 5 mA, complete with all rectifying valves, 92/6 each. Limited number only.

Television. Receiver type 1355. Brand new, complete with all valves, for Sutton or London, 49/6 each.

Television. Brand new "Pye" 45 Mc/s I.F. strips, using 5 EF50's, diode stage EA50 and cathode follower EF50, complete with all valves, 59/6 each ; ditto less valves, 37/6.

Condensers. "Trouble Free" oil filled, .1 mfd. 5000 volt, the only safe condensers to fit in your television. Limited number only, 2/6 each.

Chokes. L.F. 3 henry 200 mA 100 ohms, 3/6 each ; 5 henry 200 mA 100 ohms, 3/6 each ; 20 henry 100 mA 350 ohm, 6/6 each.

Condensers. Block type electrolytic, 8 mfd. 750 volt, 4/6 each ; 16 mfd. 750 volt, 5/6 each ; 16 x 16 x 16 mfd. 450 volt, 3/6 each.

11 volt Rotary Packs. Fully smoothed input and output, giving 220 volt 60 mA, 17/6 each.

Open all day Saturday

G. W. SMITH & CO.
(RADIO) LTD.
3, LISLE STREET, LONDON, W.C.2
Phone : GERrard 8204

NEW GRAMOPHONE AND SOUND EQUIPMENT

AVAILABLE from stock; good quality 33⅓-rpm motors, including turntable and rubber mat, £4/11; Decca 337B, playing-desk, £16/16; Decca 33B and 33C playing-desks, £12/1/6; Connoisseur twin-speed motors, £20/19/3; Decca l.p. records; despatched post free.—Rogers Developments Co. (M.O. Dept.), 116, Blackheath Rd., S.E.10. [6803

MAGNETIC tape recorders.—Make your own simply and easily; Cleartone recorders (10 watt) specially designed for amateurs, crystal clear, silent running, superb performance comparable professional machines; simplified instructions, blueprints, 5/9 post free; kits supplied.—Karnshaw Hare (member B.S.R.A.), Lydford, Devon. Tel. 266. [6596

CINE-VOX disc recording equipments, type C7J for high-quality recordings from existing microphone equipment, price from 28gns; also available as a complete channel inclusive of mic., amplifier and playback equipment, at 70gns; type C7, for highest quality professional requirements—recorder mechanism at 46gns, or complete channel at 110gns; demonstrations arranged in London.
PLEASE write for details to K.T.S., Ltd., 60, Aylward Rd., London, S.W.20. (Liberty 2426.) Callers by appointment only. [6724

GRAMOPHONE AND SOUND EQUIPMENT —SURPLUS AND SECONDHAND

SCOPHONY-BAIRD tape recorder, brand new; best offer.—Box 0640. [6743

DOUGLAS No. 3 coil winders for sale.—Banner Electric Co., Ltd., Hoddesdon, Herts. [6780

WILKINS & Wright pick-up and transformer, as new; £5.—Oxley, 372, Staniforth Rd., Sheffield, 9. [6786

COSSOR 339DB oscilloscope, £25; Variac 100L, 0-230v 2kw, £10; both new condition.—Box 0705. [6765

CONNOISSEUR pick-up in table cabinet, Collaro motor, 12in turntable; £8/10, or sell separately.—Oakdale, Woburn Town, Bucks. [6715

WIRE recording constructional details 1/6; stainless steel recording wire, 3,600ft reels, 4/9.—12, Rossendale Ave., Blackley, Manchester, 9. [6555

B.S.R. recording unit, complete, as new, excellent reproduction; £150 or near offer.—"Metronome," 33, Backville Rd., Bexhill, Sussex. [6762

FOR sale, Autotrop radio-gramophone, takes 30 mixed records and plays both sides through; two 12in loudspeakers.—Full information from Heenan, Little Gaddesden 3130. [6776

MAGNETIC sound recording wire, stainless steel, temporary wooden spools, approx 1¼ hours' running time at 2ft per sec.; 14/- per spool.—A. Smart, 40, Grange Rd., Halesowen. [6491

LEAK Point One amplifier, with latest model Re/Pu, £28; Voigt Domestic corner horn, in white, fitted PM2 unit, £65; Gerrard Auto mixed changer, fitted connoisseur L.W. pick-up, £10 ; above demonstrated Central London.—Reply Box 0707. [6770

GRAM motor, rim drive, 200/250v a.c., £5; Goldring magnetic pick-up, £1/10; Hoover induction motors, SP501, suitable tape drive, 200/250v a.c., £1/10; smaller model, £1/5; Vibrator h.t. units, 6v input, 200v d.c. smoothed output at 40 ma, £1/10.—Box 0698.
COOK, Old Barn Rd., Christchurch, Hants. [6800

NEW COMPONENTS

HANNEY OF BATH offers:—
WILLIAMSON amplifier, complete kit of 25 resistors and pots for the main amplifier, with matched pairs where necessary, 27/-; kit of 9 high stability and carbon resistors for the pre-amp (fig. 15), 8/7; kit of 23 H.S. and carbon resistors for the 3-valve pre-amp (fig. 15), 19/9; kit of 18 H.S. and carbon resistors and 4 pots (fig. 19), 30/-; kit of 15 condensers for fig. 15, 47/-; kit of 35 condensers for fig. 19, 54/6.
COMPLETE Williamson tone compensation unit, wired and tested (fig. 19), a laboratory job, £11/11 (less valves); matched pairs of resistors, 47K 2 watt 3/-, 22K 1½ watt 2/- pair; Dubilier high stability resistors, all Williamson values, ½ watt ±5% 1/3, ±1% 2/3, 1 watt ±5% 1/-, ±1% 2/-; silver mica condensers, finest quality only, no surplus, 25 to 500 pfd, ±5% 1/-, ±1% 1/3, 1,000 pfd ±20% 1/-, 4,000 pfd 2/-; 5-bank 6-position switch, a few left at 7/6; matched pair KT66 valves, 42/6; PX4 ditto, 36/6; 6V6 ditto, 31/6; KT63 ditto, 31/8; complete kit of parts for 4 watt amplifier, with bass and treble tone controls, £6/6, or complete with instrument case, £6/19/6; hand pass convertor coils (Oct. W.W.), set of 4, 10/6; Eddystone 739 split stator, 7/9; wobbulator coils, 5/6 pair; also 16HT 28 rectifiers, resistors and reliance pots, etc., for the above 2 designs. Goodmans Audium 60 15/-, ditto 150 16/8. "Wearite" P coils, 5/- each; Denco type "C" coils, 6/6 pair.
WIRELESS World TV Superhet, complete set of 20 coils wound exactly to designers' specifications, 45/-.
POLYSTYRENE formers, 1⅛in×⅜in, tapped 0BA for slug, with fixing hole, 1/-; 2⅛in×⅜in, 9d.
PAXOLIN formers, 1⅛in×⅜in, tapped 0BA for slug, 9d; 1⅝in or 2in×⅜in, 8d; 1⅝in×⅜in 9d; polystyrene varnish, large bottle, 1/10; 0BA screwed rod, copper 2/- ft, brass 1/- ft; all other components and accessories ex-stock as previously advertised.
ALL Avo and Taylor instruments supplied, list on request. We supply everything for W.W., P.W., E.E. and Bernards designs . . . get our quotation, retail only; send 3d stamp for lists.
L. F. HANNEY, 77, Lower Bristol Rd., Bath. Tel. Bath 3811. [6505

SENSATIONAL DEVELOPMENT of the NEW 1355 CONVERSION!

Data for all FIVE TV CHANNELS 3/-

POWER UNIT 5441B. Separate individually controlled H.T. and L.T. transformers, jewelled indicator lights, attractive grey crackle case, and modest size (14in. x 7½in. x 7in.), 300 v. at 200 mA fully smoothed, 12 v. at 3 a. A.C. and 5 v. D.C., make this one of to-day's best bargains. ONLY 65/-.

AMPLIFIER 1135A with EBC33, EK32 and EL32 ; our "10 min. conversion" data and circuit, provided with the unit, will turn this into a really fine little amplifier. Inputs for mike or gram. OUR PRICE 16/6.

MAINS POWER PACK KIT. Suitable for the above, with our improved conversion data. 19/6.

RECEIVER P40. Covering 85-95 mc/s, these may be converted for "2" or for the B.B.C. U.H.F. F.M. Crystal controlled oscillator with subsequent multiplication ensures stability. With 4 EF54s (RF, mixer and multiplier), EC32 (L.O.), 2 EF39s (2.9 mc/s IFs), EB34 (det.) and 6J5 and 6V6 (audio), they are housed in robust attractive grey cases. ONLY 65/- in original cartons.

VIBRATOR 21. 6 v. input, approx. 160 v. at 40 mA. output, these were designed to supply the receiver 21 and its associated transmitter. 15/6.

TRANSMITTER 21. The remaining section of the above, this will send CW, MCW or speech on the same frequencies as the receiver. Complete with valves, control box, key front panel (for mounting all three sections together) and circuit. PA coils and relays stripped by M.O.S. In excellent condition. 25/-.

RECEIVER 3547. With 15 EF50s, eight other useful valves and hundreds of components, this contains a "Pye 45 mc/s Strip" which is ideal for London TV. Brand new in original Maker's Crates. ONLY £6.

ACCUMULATORS. Brand new, multi-plate, in unspillable celluloid cases (3¼in. x 1¾in. x 4in.) ; 7 A.H. 2 v. 5/11.

Ex-U.S. BLOWERS. Ideal for cooling purposes, or as small motors : 1¾in. dia. x 2½in. long, they require 24/28 v. A.C. or D.C. 9/6.

RADIO EXCHANGE CO.,
9, Cauldwell Street,
BEDFORD. Phone 5548.

They all say "Thanks"
. . . Thank you for your letter of the 7th Nov. and the interest you have taken in my very small order. I shall find no difficulty in following your instructions for phasing the windings. I must say that I admire your arrangement which gives seven useful output impedances with only five secondary windings.
H. L. M. South Africa.

SAVAGE TRANSFORMERS OF DEVIZES LIMITED

SAVAGE TRANSFORMERS LTD.
Nursteed Road · Devizes · Wilts
Tel: Devizes 536

THE HOUSE FOR QUICK DELIVERY

The following Goods Ex Stock. Cash with Order, or C.O.D.

COLLARO Single Record Player, complete with Pick-up. Limited quantity ... £6 11 6

PLESSEY Single Record Player, complete with Pick-up. Limited quantity £6 16 2

LEAK TL/12 Watt Loop Feedback Amplifier £25 15 0

LEAK RC/PA/U Pre-Amplifier ... £8 15 0

CHARLES Concert Master £29 10 0

CHARLES K51 amplifier £17 17 0

MARCONIPHONE Model 14. Light Weight Pick-up. Including P.T. £2 11 8

ACOS Pick-up Head G.P.19 ..... £2 3 4

Send me your order for all your :—
Wharfedale speakers (full range ex stock).
Test Meters—Avo, Taylor, Advance.
Valves. Components.

Please note : These prices are subject to any increases by the makers due to rise in costs.

All Wharfedale Speaker Range Ex Stock, see "Wireless World" Feb. and March.

A. ERNEST BUCHAN (M.O. Dept.)
28, BELMONT ST., ABERDEEN
Telephone 23579

NEW COMPONENTS

CRYSTAL microphone inserts (Cosmocord Mic-6), guaranteed brand new; 15/6, post free.—RADIO-AID, Ltd., 29, Market St., Watford. Tel. Watford 5988. [0036

TELEVISION, EHT, pulse in, 7-8kV out, small treble unit using Westher and T.C.C. parts, assembled on subchassis; 77/6.—WIRELESS World, sensitive, all-station superhet. BOOKLETS, very informative, suit beginner; 5/-. PARTS list, all parts supplied.—RF strips, copper, with boxes and V/H; 52/6. COIL sets, 20-piece, all channels; 42/6. FOCUS coils, heavy, potted, 1 ohm; 37/6. DEFN. coils and line trans., pair, 77/-. MAINS trans. and choke, heavy, pair, 127/-. PREFABRICATED chassiswork, all angles, etc.; 120/-. GERANIUM recs., GX44, 10/6; EHT recs.; also new Hunts condensers, Reliance pots, resistors, valves, CRT.—RADIO:—WOBBULATOR coils, 7/6; Xtal set coils, highest Q, push-pull idea, 6/ ea.; unassembled s/het, 3-band C/packs, separate coils, exc. performance, few, 16/6; April. BARGAIN, EE power and TB chassis, 12/6 pair (add post); trade supplied.—BEL SOUND PRODUCTS Co., Marlborough Yard, London, N.19. Arc. 5078. [0183

GARLAND RADIO, Chesham House, Deptford Broadway, S.E.8. Please see our displayed advertisement under name Garland Brothers on page 76. [0192

ALLEN & GOULD, 5, Obelisk Parade, Lewisham, S.E.13. Please see our displayed advertisement under name Garland Brothers on page 76. [0191

RADIO components, valves, transmitting equipment, television accessories, telephone equipment, electrical measuring instruments, electronic apparatus, etc., etc.—EXPORTERS and others requiring or having for disposal, any of these items, are invited to contact us for immediate attention and service.—R. C. SERVICES (RADIO), 12, Theobalds Rd., London, W.C.1. Telephones: Chancery 3253/4. [6719

EHT Transformers, mains transformers, output transformers and chokes; open or potted types; transformers designed to individual specification; singles or in quantity.—WILLESDEN TRANSFORMER COMPANY, Ltd., 20a, Church Lane, Church Road, N.W.10. [0075

YOU are bound to try an Osmor "Q" Coil-pack eventually and be delighted with the results; why not save time and money now? Send a stamp for free circuits and latest lists of coils, coilpacks, dials, etc., etc.—OSMOR RADIO PRODUCTS, Ltd., (Dept. W.C.A.), Borough Hill, Croydon, Surrey. (Tel. Croydon 1220.) [0046

EVERYTHING for home constructor, chassis, condensers, coils, valves, resistors, gram units, speakers, test gear, Viewmaster kits, etc., cash or H.P.; stamp for lists; quick service, no Govt. surplus offered.—BCM/EDHWA, London, W.C.1. [6227

MIDGET TRF Pre-set 3-station Coilpack Kits as previously advertised, 15/-; midget relays, 5,000 ohm coil, weight 1oz, 10/-; special Viewmaster pre-amp kit, exact to author's specification with valve and instructions, 42/-; brand new 6V6GT/G valves, 7/6 each; all c.w.o.—A. P. Creton (W), 349, Copnor Rd., Portsmouth. [6634

15/- pair only; we can now supply the world-famous "MM" I.F. transformers (variable iron dust cored, high "Q," high stability) pre-aligned to 465 Kc/s at only 15/- pair; iron dust cored coils for standard wavelengths available at 3/- each; Coil Group A consisting of 6 Supaconils of our own selection from our range), 1 four pole three way switch, 2 fixed padders, suitable for coils selected, and 6 variable trimmers, all for 26/9; Coil Group B, similar to above but with 9 coils (your choice), six pole three way switch, 2 padders and 9 trimmers, all for 43/9; Home Constructor's Handbook, 2/-; see also our display advertisement in this issue.—SUPACOILS, 98, Greenway Ave., London, E.17.

COMPONENTS—SURPLUS AND SECONDHAND

C. J. EMMS, Ltd.

RECTIFIERS, full wave bridge type, as follows: 1 amp, 12 or 6v, 5/6; 3 amp, 12 or 6v, 12/6; 4 amp, 12 or 6v, 15/-; 7 amp, 12 or 6v, 17/6; 7 amp, 6 or 12v, 22/6; 24v 1 amp, 11/-; 24v 3 amp, 25/-; 24v 4 amp, 30/-.—NEW sliding resistance sets from 1 to 4 amp 14 Ω, to 12 amp 9 Ω; in all, 30/- per carton.—26a, Colherne Mews, London, S.W.10. Fremantle 8941. [0201

SEND s.a.e. to-day for our latest list to WALTON'S WIRELESS STORES, 205, Staveley Rd., Wolverhampton. [0061

MAGSLIPS at 1/10 to 1/20 of list prices, huge stocks, please state requirements.—K. LOGAN, Westalley, Hitchin, Herts. [6369

230,000 Simmonds fibre collar, type 6BA brass hex full nuts, 8/6 per 1,000, carr. paid 20,000.—D. C. WOODBERRY, Engineers Supplies, Treforest Estate, Glam. [6367

CRYSTALS, 7290 and 7275 k/cs, 2 in thermo can, 2/6, postage 6d.—Ellis, Westwoods, Caswell Bay, Swansea. [6725

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport Street, London, W.C.2. See our displayed advertisement page 96. [0016

POWER unit, type 280, contents 4×CV54, 5U4G, VR65, 6 relays, 4 selenium rectifiers, 5 Jack sockets, transformers, smoothing chokes, condensers, resistors, plug sockets, valveholders, etc.; all on chassis in louvered case, size 20in×12in×12in, new, unused in packing case; clearance price, 22/6.—Logan, Westalley, Hitchin, Herts. [6760

QUALITY PAYS!

We've a sense of values at QUALITY MART. Engineering values—because we're engineers. Cheap sound equipment is often not sound value.

NEW CAPACITORS. By famous makers, only a few thousands at this exceptional price. Buy now. Most popular values available, paper dielectric, waxed tubular, wire ends. Fully Guaranteed, Tested Goods. 100-1000 pF. (some silver mica), 6/6 doz. ; 1500 pF.—0.1 mfd., 8/6 ; all 500 v. working ; .25 and .5 mF., 350 v. working, 10/6. **Special**—3 doz. our selection, various types, 21/-.

DUBILIER Drilitic, at maker's list prices, 8 and 16 mF. tubular wire end, 500 v. working, 4/- and 6/- ; 8mF. tubular can, 500 v., 4/6.

PICK-UP VALUES. Marconi No. 14 light-weight moving iron. Latest streamlined model, similar to model in B.B.C. use, with bass-correction, transformer, etc., 0.5 v. output. Half last year's price, to-day's best value, 40/4.

MOVING COIL P.U. light-weight, walnut moulded case, well-known maker, complete with high-output transformer 0.25 v., listed 53/4. A few offered at 33/6 in maker's cartons.

SAPPHIRE AND RUBY miniature needles to suit these and other popular pick-ups, "QM," 7/- and 9/- ; Starr Sapphire Stylus, 10/-. Motors—stamp for details.

LOUDSPEAKER. Between the cheap speaker and the expensive jobs, a **GOODMAN** 10in., 15Ω, at 36/-. Transformers available.

AMPLIFIERS—GRAMOPHONE MOTORS —ALL RADIO PARTS—NEW VALVES—L.P. RECORDS—RADIO AND MUSICAL TEXT-BOOKS AND POPULAR BOOKLETS.

Enquiries invited (2½d. stamp, please). List in Preparation. Advts. in future issues will interest you. Look next month in the classified columns for "NEW COMPONENTS" and "GRAMOPHONE EQUIPMENT."

FOR SATISFACTION
MAIL ORDERS ONLY TO
QUALITY MART
110 VILLIERS ROAD, WATFORD

NO REGRETS
if you make
HOLLEY'S RADIO STORES,
285, CAMBERWELL ROAD, S.E.5.

your first call when purchasing new High Fidelity Equipment.

Side by side Demonstrations of

NEW ACOUSTICAL Q.U.A.D. RADIO TUNER AND AMPLIFIER
CHARLES R.C. TUNING UNIT AND K51 HIGH FIDELITY AMPLIFIER
LEAK T12 AMPLIFIER, R.C. PAU PRE-AMP and SUPERHET RADIO TUNER
WILLIAMSON AMPLIFIER AND TUNER BY GOODSELL
SOUND SALES A-Z AMPLIFIER AND DX PLUS RADIO TUNERS
ARMSTRONG ALL WAVE CHASSIS
FELICITY L.P. JUNIOR AMPLIFIER AND TUNER

Recommended SPEAKERS
TANNOY "DUAL CONCENTRIC"
WHARFEDALE CORNER DUAL
BARKER 148a and 150 UN'TS
GOODMANS AXIOM 150 AND AUDIOM 60
DECCA CORNER SPEAKER AND LONG PLAYING RECORD EQUIPMENT
TWO-SPEED MOTORS AND L.P PICK-UPS
RADIOGRAM AND CORNER SPEAKER CABINETS

Open all day Saturday.
'Phone : RODney 4983

"DEMOBBED" VALVES MANUAL

2/9 Post Free

giving Equivalents of British and American service Types and Cross Reference of Commercial Types, with an Appendix of B.V.A. Equivalents and comprehensive Price List.

3/16in. DIA. BIT SOLDERING Instrument, Miniature Type, to meet every requirement for Radio, Television, etc., **22/6**, post 1/-.

HEADPHONES (S. G. BROWN) High Resistance and Lightweight Type, Standard D.C., 4,000 ohms, **27/6**, post 1/-.

LOUDSPEAKERS, Baffle with Volume control, in Luxury Cabinet, **35/6**, post 1/6.

MULLARD MANUAL, with Base Diagrams, **5/6**.

MORSE BUZZER OUTFITS. Consisting of a buzzer, a Morse key, and a Battery-Compartment, all mounted on a polished Base Board. All parts high grade ex-Air Ministry. An excellent gift for a boy, **6/-**, post free.

CONDENSER TESTER and Rectifier Unit, plugs straight into A/C Mains 200/240 v. and is indispensable for examination of condensers. Very slight and intermittent leakages which cannot be discovered by conventional Instruments can be traced by this Unit. Complete **39/6**.

SERVICE SHEETS, the one you require on FREE Loan if you buy one dozen assorted at **10/6**.

RESISTOR Colour Code Discs, **1/-**.

AMPLION TEST METER. 1,800 ohm per volt on all D.C. and A.C. ranges, 10 v., 100 v., and 500 v. D.C. and A.C., 50 mA. and 500 mA. D.C. Resistance up to 200,000 ohm. (3,000 ohm. centre scale), with self-contained battery, 5,000 volt range with a separate H.T. test prod (**9/6** extra). Supplied with test prods. Multi-colour scale easily readable, **£4/7/6**.

2in. BALANCED ARMATURE TELEPHONE INSERTS, 4/-.

MORSE TAPPERS, ex-Govt., **2/-.**

1 FOOT AERIAL RODS, ex-Govt., doz., **6/-.**

HYDROMETERS, iron-break type, **6/-.**

ELECTROLYTIC Condensers, 25 mfd., 25 v., **1/-** ; 5 mfd., 35 v., **1/-.**

TEST PRODS, Superior Product, **3/6.**

ERIE RESISTOR KITS, containing 96 ½-watt insulated Resistors, all clearly marked, in metal cabinet, **£2.**

POSTAGE 1/- extra.
Goods can be sent C.O.D. (over 20/-).
Kindly mark envelope (WW5)

RADIO **BULLS** VALVES
246 HIGH ST. HARLESDEN NW10

COMPONENTS—SURPLUS AND SECONDHAND

RADIO CLEARANCE, Ltd.

TELEVISION! Set of 3 components, comprising line output trans., with E.H.T. winding to give 7 kV, using EY51 (heater winding for EY51 also included), and fitted with width control; scanning coils, low impedance line and frame; focus coil (res. 10,000Ω, current approx. 20 mA); the set of 3 for 42/- p.us 1/6 post; scanning coils, as "Viewmaster," low imp. line and frame, 12/6 plus 9d.

MINIATURE iron cored coils, former size 1⅝×⅝in. adjustable core, set of 4 coils, M.W., AE and OSC, S.W., AE and OSC, 5/11, post 6d; mains dropping resistors for 15a valves, 920Ω, tapped at 650 and 700Ω, small size (3in.×¾in.), 2/3.

A.C./D.C. amplifiers, complete kit for construction of 20w 8v amplifier, by McMurdo, all first-class components by Partridge, Gardner, etc., valves 4×CL33, 2×EF37, 2×UR3C, black crackle, chassis and case, isolated from mains, and drilled, circuit diagram supplied, everything complete, £10/19/6, carr. paid; television focus coils, for 9 or 12in mag. tubes, res. 10,000Ω, average current 20mA, 7/6, post paid.

PERSONAL receivers, 5 valve T.R.F., using 1T4's, contained in handsome bakelite case with lift-up lid, size 7×6½×5in with lid closed, plastic carrying handle, tram AE in lid, these receivers cover the medium waveband and operate from self-contained dry batts., standard types, W1435 and D2, output to a pair of lightweight 'phones (H.R.) controls, SM tuning and reaction, opening lid switches on, supplied brand new, with valves, batteries, 'phones, an ideal set for invalids, hosp. patients, etc., these receivers are not Govt. surplus and are offered ready to play; carr. paid £3/19/6.

CHASSIS steel 5¼×5¼×1¼in drilled 5 button base holes 1/9, 5×9×2in drilled 5 button base holes; 2/5; all 17×9½×2¾ drilled 7 int. octal and square, open ends 3/-, all 14¼×10×2½ drilled 10-B8A, 5 int. octal, ex. T.V. 4/3; E.H.T. trans. 4kv 1ma, 2v 2a secs. primary 230v. 50c/s, gives approx. 5,500v with usual smoothing, 29/6; primary 0-110-210/240v 50c/s, secs 300-0-300v 80ma, 4v 2a, 0-3v 2.5a, 15/6, heater trans., auto. wound, 200/250v 50c/s to 5v 3a, 6/-; smoothing chokes 20H, 60ma 350Ω 6/11, 5H, 200ma 100Ω 5/6, 6H 200ma 100Ω 6/6, 8H 250ma 50Ω size 4×3×5 potted 10/6 post paid, electrolytics 32mf 350v card can 2/6, 25-25v 1/3, 25-50v w/e 1/3, 50-25v 1/3, 100-12 1/3, 16-450v can 2/6, 16+48 450v can 5/-, 60mf 450v can 3/6, 8+4 450v can small 2/9, 8+4 275v 2/-, 2-150v 2/6; switches standard Yaxley type 2p 4w 2b 2/6, 2p 4w 1b with shorting wafer 2/-; superhet coils ⅛in×1¾ formers M. wave H.F. AE, Osc. L. wave H.F., AE, Osc. 1/9 per coil; I.F. trans 465k/cs 1½×1½×4in iron cored 6/- pair; mains trans metal cased 0-15-600v 2in circular, req. ext. res 6/6; meters 2in square bakelite cased 0/1ma 9/-, 0/5ma 6/6, 0-50ma 7/6, 0-500v d.c. with series res. 7/6, 0/20v 5/6; bakelite cased 2in circular 0/100ma 9/6, 0/200ma 9/6; Rotary power units type 104, p.m. rotary mounted on chassis with supp. input 12v d.c. output, 250v 60ma, 6.5v 2.5a d.c. 6/-, type 87 24v input trans as 104 5/- post paid; plugs and sockets, bakelite with keyway 5, 7, 10-way, 1/6 pair; 8-way "Jones" with cover 1/6 pair; bakelite cases with lid, inside mens, 6×6½×3¼, without lid, lid 1in deep, with former for frame AE, lid requires fixing, ideal for personal sets, meters, etc., 6/6 post paid; extension speaker controls 10Ω wire wound, ¼in spindle 5/-; "Pye" Strips" the well-known 45mc/s vision strips, brand new, less EF50s, with EA50, perfect condition, 59/6, p.us 1/6 post; focus coils, low res., 200Ω, standard TV 6/6, can be had as alternative with kit, if required; loudspeakers, p.m., 3in trans., boxed, 12/6 post paid; Mansbridge conds., 4mf 1000v wkg. 5/-; v.c. with sp switch long spindle 25k 50" 100k 250", 2/-.

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188.
[0015

SUPREME RADIO, 746b Romford Rd., Manor Park, London, E.12. Tel. Ilf. 1260. Est. 16 yrs. More new bargains at the right price.
EX-Govt. m/c meters, 0-300v, with shunt resistance, 7/6 ea.; C.V.102 crystal diodes, 2/6 ea.; 3 meg. carbon vol. controls, 2½d ea.; 100K(Ω) vol. controls with long spindle and S/P switch, 2/6 ea.; 0.25MΩ vol. controls, long spindle, less switch, 2/- ea.
WESTINGHOUSE type metal rectifiers, 250v, R.M.S., 65m/a, 4/- ea.; 2-pole 2-way small switches, 8d ea.; E.F.50 valve holders, 6d ea.; retaining rings for same, 8d ea.; B7G valve holders, amphinol type, 9d ea.; noise suppressor units consisting of .1 .01 .O-IMFD cond. and iron-cored choke, 6d ea.
650Ω, 0.2amp flat-type mains dropper, tapped for 200-250v, 1/6 ea.; 16mfd 350v Dryllic cond., 1/9 ea.; 50mfd 50v tub. cardboard bias cond. 1/- ea.; 465kc/s standard size I.F.T.s, 8/6 pr.; fly-back type line-trans., with provision for EY51 valve, 22/6 ea.
PERMANENT magnet focus units, for triode or tetrode tubes of high flux-type; an amazing bargain; state type required; 16/- ea.
TERMS c.w.o. no c.o.d.; send 6d extra for postage orders under £5; 2½d s.a.e. all enquiries and list.
[0021

LITTLEWOODS, North London's best select.on of radio and te.evision components; pay us a visit or post or 'phone your enquiries; no lists.
LITTLEWOOD & GRUNER, Ltd., 27, Ballards Lane, Finchley, N.3. Fin. 3090.
[0095

350-0-350v 80ma, 6.3 and 5v mains transformers, new but soiled, 13/-, post 1/4; callers, 1155B receivers converted a.c. mains, £7/10.
CHAMPION, 43 Uplands Way, London, N.21. Lab. 4457.
[0101

GALPIN'S

ELECTRICAL STORES,
408, HIGH ST., LEWISHAM,
LONDON, S.E.13.

Telephone : Lee Green 0309
Near Lewisham Hospital

Terms :

CASH WITH ORDER. NO C.O.D.
EARLY CLOSING DAY THURSDAY.
ALL GOODS SENT ON 7 DAYS' APPROVAL AGAINST CASH.

EX-RADAR MAINS TRANSFORMERS. 230 volts 50 cycles Input, 4 kV or 5 kV. OUTPUT with 3 L.T.s 6.3 v. 2 a., 2 v. 2 a., 4 v. 1 a. These transformers are in oil, new, boxed. **£3/3/-** each, carriage 7/6.

MAINS VARIABLE RESISTANCES. 14 ohms to carry 1 to 4 amps, **12/6** each; 0.4 ohms to carry 23 amps, **10/-**; 1,500 ohms to carry 0.45 amps.

MILLIAMP-METERS CENTRE ZERO MOVING COIL. 15/0/15 Milliamps. 2½in. scale, **7/6** each, post 9d. Another 0 to 10 Milliamps. **10/-** each, post 9d. Another reading, 250/0/250 Millivolts, **12/6** each, post 9d. All new, boxed by well-known makers.

VOLTAGE CHANGER TRANSFORMERS (New) 800 watts tapped 0, 110, 200, 230 volts can be used either way. **65/-** each, carriage 3/6.

ELECTRIC LIGHT CHECK METERS, quarterly type, for sub-letting garages, apartments, etc., all fully guaranteed electrically for 200/250 volts A.C. mains, 50 cyc., 1 ph., 5 amp. load, **17/6** each; 10 amp. load, **20/-** each; 20 amp. load, **25/-** each; 50 amp load, **37/6** each; carriage 2/- extra on each; special discount of 10 per cent. on quantities of one dozen or more.

POWER TRANSFORMER AUTO WOUND, voltage changer tapped 0, 110, 190, 200 and 230 volts at 1,600 watts, **25/-** each, carriage 3/6; ditto, 2,000 watts, **28/-** each, carriage 3/6; another tapped 0, 110, 200, 230 volts at 350 watts, at **15/6** each, carriage 2/-.

DOUBLE WOUND 2,000-WATT VOLTAGE CHANGER TRANSFORMERS. 230 to 250 volts or vice versa, weight 100 lb., **£10** each, carriage 10/-.

MAINS BOOSTER TRANSFORMERS. 1,500 watts tapped 0, 6, 10, 19, 175, 200, 225, 240 and 250 volts, good condition, electrically guaranteed, **£4/15/-** each, carriage 5/-.

HIGH CYCLE ROTARY CONVERTERS. 24 volts D.C. Input 100 volts, 2-phase, 400 cycles, approx. 60 watts output, as new, **35/-** each, carriage 3/6.

SWITCHBOARD METERS. 4in. scale 0 to 14 amp D.C., **17/6** each; 0 to 30 amps A.C./D.C., **22/6**; 0 to 14 amps A.C./D.C., **22/6** each. All fully guaranteed.

MAINS TRANSFORMERS (New). All 200/250 volt primaries in steps of 10 volts. Output 250/0/250 volts, 300 mA, 6.3 v. 8 a., 6.3 v. 6 a., 4 v. 4 a., 0 v. 4 a., **62/6** each; 500/0/500 volts 300 mA, 6.3 v. 8 a., 6.3 v. 8 a., 0 v. 4 a., **62/6** each; 500/0/500 volts, 4 v. 4 a., 300 mA, 6.3 v. 8 a., 6.3 v. 8 a., 6.3 v. 4 a., 0 v. 4 a., 3 v. 4 a., **67/6** each; 350/0/350 volts, 250 mA, 6.3 v. 8 a., 4 v. 8 a., 4 v. 4 a., 6.3 tapped 2 v. 2 amps (Electrovalve), **57/6** each, carriage 3/6.

MAINS TRANSFORMERS (New), all with 200/250 volt primaries in steps of 10 volts; output 250/0/250 volts, 150 mA, 6.3 v. 5 a., 5 v. 3 a., **37/6** each; 350/0/350 volts, 180 mA, 6.3 v. 4 a., 5 v. 3 a., 4 v. 4 a., **37/6** each; 500/0/500 volts, 150 mA, 6.3 v. 5 a., 4 v. 4 a., 0 v. 3 a., **42/6** each; 425/0/425 volts, 160 mA, 6.3 v. 5 a., 6.3 v. 3 a., 5.3 a., **39/6** each, carriage extra 1/6.

MAINS TRANSFORMERS. 230 volts, 50 cys., 1 ph. input, tapped output, 0, 6, 12, 18 volts at 4 amps, at **17/6** each, post 1/6; another 230 volt input, 700/0/700 volt, 70 mA, 12 v. 1 a., 4 v. 2½ a., **27/6** each, post 1/6.

METERS, EX-W.D. SURPLUS (New), 2in. scale, moving coil, 0 to 20 volts, **6/-** each, post 9d.; another 0 to 40 volts, **7/7** each, post 9d.; another 0 to 10 amp, **13/6** each, post 9d.

DUCON VARIABLE TARIFF ELECTRIC LIGHT 14/1s. SLOT METERS, all fully guaranteed 200/250 volt A.C. mains 5 amp. load, **42/6** each, carriage 2/6; 20 amp. load, **57/6** each, carriage 2/6.

SMALL SIZE CREDIT-TYPE ELECTRIC METERS. 200/250 volt A.C. mains, overall size 4½in. × 3½in. × 3½in., weight 4 lb., 10 amp. load, **25/-**, post 1/-; 20 amp. load, **30/-**, post 1/-; 30 amp. load, **35/-**, post 1/-, fully guaranteed electrically.

ROTARY CONVERTERS. 24 volts D.C. input, 50 volts 50 cycles, 1 ph. at 400 watts output, complete with step-up Transformer from 50 to 230 volts, **£7/10/-** each, carriage 10/-, condition as new.

ROTARY CONVERTERS, EX-NAVAL, well-known makers, 100 volts D.C. input, 230 volts 50 cys. 1 phase at 200 watts output, capable of 100 per cent. overload, weight 100 lb., condition as new, **£10/10/-** each, carr. paid.

EX-R.A.F. MICROPHONE TESTERS. These contain a 2½in. scale 0 to 450 microamp. meter shunted to 1 m/amp, call-rated 0 to 10 volts, moving coil, complete with 1 μA rectifier, "mike transformer," etc., all contained in polished wood box, as new, **17/6** each.

MAINS TRANSFORMERS (New). All 200/250 volts input in steps of 10 volts. Outputs 0, 6, 12 and 24 volts at 10/12 amps., **47/-** each; 4, 18, 30, 36 volts at 8/6 amps., **42/6** each; 0, 6, 12 and 24 volts at 20/26 amps., **66/6** each; 0, 6, 12 and 24 volts at 5/6 amps., **35/-** each.

SUCCESSFUL SALES! SATISFIED CUSTOMERS!

PENNINE RADIO

THE ALL SEASON SENSATION. ACCLAIMED THE COUNTRY OVER. THE INTIMATE RECEIVER WHICH COMBINES APPEARANCE AND PERFORMANCE. HOUSED IN A BEAUTIFUL WALNUT CABINET. EACH SET FULLY GUARANTEED.

HEIGHT 10", WIDTH 12½", DEPTH 5½"
4 Valve SUPERHET

THE SET THAT SELLS ITSELF! — *UNBEATABLE VALUE* £12 15 2 INC. TAX.

"THE ROVER"

SUPPLIED ONLY THROUGH SELECTED WHOLESALERS. ILLUSTRATED LEAFLETS AND ATTRACTIVE DISPLAY CARDS.

PENNINE AMPLIFIERS

ELLAND YORKS ENGLAND

TEL. ELLAND 2107

THE MODERN BOOK CO.

The Radio Amateur's Handbook 1951 Edition. By A.R.R.L. **22s. 6d.** Postage 10d.

Post War Communications Receiver Manual. By H. W. Sams. **27s. 6d.** Postage 10d.

Time Bases. By O. S. Puckle. **30s.** Postage 10d.

Surplus Radio Conversion Manual.—Volumes I and 2. By Evenson and Beach. **21s.** each. Postage 6d.

Practical Wireless Encyclopaedia. By F. J. Camm. **21s.** Postage 10d.

Radio Engineering. By F. E. Terman **50s.** Postage 10d.

Practical Wireless Service Manual. By F. J. Camm. **8s. 6d.** Postage 6d.

Television Receiving Equipment. By W. T. Cocking. **18s.** Postage 9d.

Voltage Stabilizers. By F. A. Benson. **12s. 6d.** Postage 5d.

Sound Reproduction. By G. A. Briggs. **10s. 6d.** Postage 6d.

Ediswan Mazda Valves. 1949-50. **2s.** Postage 3d.

Magnetic Tape Recording. By P. A. Tarry. **6s. 6d.** Postage 3d.

Micro-Wave Measurements. By H. M. Barlow & A. L. Cullen **30s.** Postage 10d.

Fractional Horse Power Motors. By S. F. Philpott. **30s.** Postage 10d.

The Williamson Amplifier—Reprints from "Wireless World." **3s. 6d.** Postage 2d.

We have the finest selection of British and American radio books in the Country. Complete lists on application.

19-23 PRAED STREET
(Dept. W.5)
LONDON, W.2
PADdington 4185

COMPONENTS—SURPLUS AND SECONDHAND

SYNCHRONOUS clock units, self-starting, 200-250v a.c., 50 cycle, fitted Sangamo motors, consumption 2½ watts, size 2⅝in diam., 2in deep, geared 1 rev 60 mins friction reset.

IDEAL movements for making electric clocks, time switches, etc., complete with 12 to 1 dial train and 5in hands, price 22/6, post paid.

SANGAMO as above, final speed one rev per min, less dial train, ideal for dark room process time, etc., price 20/- each, post paid.

NEW ex-R.A.F. English Electric electronic ignition testers, type Ref. No. 5G/447, input 230 volts a.c. 50 cycles, 6/12-24 volts d.c., £19 each.

STEP-DOWN transformers, input 250v a.c., 50 cys., output 6.3-0-6.3 volts 19 amps; £2/12/6 each.

ADMIRALTY pattern heavy duty l.t. transformers, primary 230 volts 9 amps, secondary 18 volts 106 amps, centre tapped; £12/10 each.

WESTINGHOUSE rectifier sets, style 28B, G.P.O., input 200-250 volts a.c., 50 cycles, output 50 volts d.c., 1½ amps; £3/10 each, carr. paid.

DITTO rectifier sets, output 50 volts d.c., 3 amps; £6 each.

BATTERY chargers, input 230v a.c. 50 cy., output 6/12 volts d.c. 4 amps., continuous rating, fitted in metal case 12×6×6in, 5 amp meter and fuses also mains switch on front panel, selenium rectification, crackle finish cabinet; £4/15 each, carr. 7/6.

SOUND reproducers type 2, fitted 33⅓ r.p.m. Garrard motor, photo electric cell, optical system, exciter lamp and transformer feed input 200/250 volts, rack and pinion focussing, neon indicator, all in metal case 9×20×12in, packed in maker's cases; price £11 each, carr. paid.

"WESTOOL" electric furnaces, 200/220 volts, high and medium heat control for heating two soldering irons, up to inch diam. bits; 50/1 each.

CONDENSERS electrolytic, 1,000 mfd. 25v d.c. wkg; 4/6 each; post paid 45/- per doz.

POWER units, input 230 volts a.c. 50 cy., outputs 12 to 24 volts d.c. .75 amps, highly smoothed ideal for relays, microphone work, etc., dimensions 10in×6in×6in, metal case; price 55/- each, post paid.

H.F. aerial change-over switches, type 78A manual or relay operation, 24 volts, size 5½in×4in×2in, £1/7/6 each.

COLVERN wire wound potentiometers with switches, sizes 10, 25, 500, 50 and 1,000 ohms, in lots of twelve or more, 32/- per doz.

PERFORMANCE meters type No. 2, fitted standard mains 230v a.c., 50 cycle, power pack, 2 V.R.91, 1 V.R.137, 1 5Z4O, 1 C.V.51, 1 V.R.92, and other useful components, £2/5 each, carriage 3/6.

A LARGE assortment of various ex-W.D. radar and radio equipment, relays, power packs, oscillograph units, gears, photographic apparatus available; s.a.e. for lists.

H. FRANKS, 58, New Oxford St., London, W.C.1. Tel. Museum 9594. [0057

230/115v step-down transformers, 75-watt, 6/6; heavy duty output transformers, weight 3½lb, two primaries, one centre tapped and one secondary 4 taps, these can also be used as small mains transformers, delivering 150-0-150v at 100 ma and 10-20-30-40v all at 65 ma. 230v input, only 4/6; amplifier chassis with 2X6A07, 1X6AG7, and chockful of useful parts, 12/6; wanted, tape or wire recorder.—Haynsons, 14, St. Mary's, Bedford. 'Phone 5568.

M.X.50 Tx., complete, £35; Eddystone 640, 1145, transmitters, communication receivers in stock. Hammerlund Super Pro, H.R.O. Senior, Hallicrafter S.52, C.R.100, A.R.88D., A.R.88L.F., etc., all in perfect order; R.1155 receivers in new condition; your enquiries are invited for rotary convertors and electric motors, most sizes and types available from stock; motor alternators, 110v d.c., input 230v a.c. 50 cycles 250 watt output, £8; special clearance of F.H.P. electric motors, 35/-, 110v-250v a.c.

UNIVERSAL a.c./d.c. motors, suitable for sewing machines, 40/- each; 12v-15v a.c./d.c. motors with extended spindle, suitable for models, etc., 9/3; 20watt P.A. rack mounting amplifier, new and complete, with heavy duty a.c. power pack, 200/250v, PX25 P.P. output, £4/10, less valves; new moving coil microphones, hand type, heavy duty and complete with 12yd screened cable, £3/15; 2 only as new B.T.H. Jenson cinema speakers, energised, and twin unit multi-cellular horn un't; 20ft telescopic tubular T/V mast, 18/6 each; large selection of test equipment; multi-range meters, valve testers, signal generators, oscilloscopes, bridge meggers, and meggers, etc., all at reasonable prices; hand bearing prismatic compasses with provision for battery in handle, perfect, 40/- each; very large stocks of transmitting valves, Klystron, of all types, send us your requirements; special offer of new, not ex-W.D., mains transformer, semi-shrouded, 200/250v tapped primary, 250-0-250, 100ma., 5v 3amp, 6v 4amp, 20/- each; large stocks of L.T. transformers, special sizes and ratings wound to specification; auto-record changers in stock from £10/15; switchboard mounting voltmeters, ampmeters, various ranges a.c. and d.c. available at cheap prices to clear; large stocks of enamelled wire, 28 s.w.g., 18 and 20 s.w.g., D.S.G. No. 15 U.X. base American valves available. Special offer: H.R.O. coils, 46-96 m/c and 180-420 k/c, 45/- each; quantity of lits and nickel chrome wire available; 3in Panoramoscope model 5A-3, type T200, £25; 100 microamp meters, 2½in scale, new, 70/- each; type 74 in. rator units, complete with tube, as new, £5 each; fluxmeters, model WY 0023, complete, new £5/10; prices do not include postage; American Dinghy transmitter type SCR578, 500kc M.C.W.

SERVICE RADIO SPARES, 4 Lisle St., W.C.2. Gerrard 1734. [0188

SOUTHERN RADIO'S WIRELESS BARGAINS

R.3515 TELEVISION UNITS. 21 valves with 6-stage 14 Mc. I.F. strip, recommended for ideal TV conversion by all experts. Brand new in original wooden cases. **£3/10/-.**

R.1355 RECEIVERS. Brand new and unused, as specified for inexpensive television. **£3/5/-.**

T.R.1196 6-VALVE SUPERHET RECEIVERS. Perfect and guaranteed. **22/6,** plus 1/4.

BENDIX RECEIVERS, type CCT46104, frequency 1.5 to 3mc/s with 28 volts. dynamotor, 6 valves. Brand new black crackle finish. **90/-.**

WALKIE-TALKIE (TRANSRECEIVER), type 38, Mark II. Complete with 5 valves, throat mike, headphones and aerial. Tested and working. **£3/10/-** carr. paid, less batteries.

ATP4 VALVES. 7/6 each.

THROAT MICROPHONES. With lead and plug—magnetic. 4/6.

CONTROL CABLES, 14ft., with adaptors or B.C.453/4/5. 9/6 each.

R.A.F. BOMBSIGHT COMPUTERS. Complete, brand new, with motors, gyro gears, blowers, etc. Ideal for model makers, etc. Best component value ever offered. **55/-** each, plus 5/-.

LUFBRA HOLE CUTTERS. Adjustable from ⅞in. to 3¼in. for use on wood, metal, plastics, etc. **5/6.**

HAND GENERATORS. 6 volts at 5 amps Complete with crank. **21/-.**

RADIO COMPASS INDICATORS, with internal Selsyn motor, 3in. dial, **13/6**; 5in. dial, **15/6.**

INVERTER UNITS, type (PE 206A) 206-A, D.C. input, 27 volts at 38 amps., 6,000 r.p.m.; A.C. output, 80 volts, 800 cycles. Complete, brand new, with spares. **£3/10/-** each.

MAP CASES. Transparent plastic, 10¼in. x 15in., with spring cover, suitable for documents, photographic display, etc. **5/6.**

STAR IDENTIFIERS with Hydrographic Office Modifications. A-N Type I. Complete in case. **5/-** each.

Full list of Radio Publications, 2½d.

SOUTHERN RADIO SUPPLY LTD.
11 Little Newport St., London, W.C.2.
Gerrard 6653.

A REMARKABLE ACHIEVEMENT IN FILTER DESIGN

Pat. Applied For

E.M.G. STEEP-CUTTING INFINITELY VARIABLE FILTER

- Cuts at any selected frequency between 4,000 and 8,000 c.p.s.
- Average steepness of cut 36 db. per octave.
- Connects between secondary of output transformer and speaker (15 ohms. rated impedance).
- Specially valuable for use with new micro-groove records.
- Greatly reduces needle-hiss on ordinary records with minimum high note loss, and suppresses high pitched interferences on radio.
- No distortion, and no appreciable loss of volume.
- Leaflet available from the manufacturers.
- *Novel circuit, patents pending.*

£4 - 10 - 0

Trade Enquiries invited

E.M.G. HANDMADE GRAMOPHONES, LTD.
6 Newman St., Oxford St., W.1.
Telephone: Museum 9971-2-3.

BAND SPREAD

by Armstrong

the NEW EXP 119

This model has been produced after exhaustive investigation into the requirements of Overseas Listeners. Ease of operation on the short-wave bands, high sensitivity and quality output have all been studied and incorporated in the EXP 119.

BRIEF SPECIFICATION

1. Designed specifically for the Overseas Listener.
2. 9 wave ranges. (6 bandspread and 3 general coverage) 11-570 metres.
3. High slope pentode R.F. stage.
4. 2 stages of I.F. amplification.
5. Variable selectivity.
6. Automatic noise limiter.
7. 10 watts push-pull output.
8. Separate A.C. power pack to facilitate operation from a vibrator if required.
9. 11 valve circuit (including cathode-ray tuning indicator).

The Armstrong range of chassis includes models from 7 to 14 valves.

Write now for catalogue.

Armstrong

THE CHASSIS PEOPLE

Armstrong Wireless & Television Co. Ltd.
Warlters Road, Holloway, London, N.7.
Telephone: NORth 3213

SOLE BIRMINGHAM AGENT

Hayes Company,
1 Alcester Rd., Moseley, Birmingham, 13.

SOLE AGENTS FOR
KENYA, UGANDA, TANGANYIKA & ZANZIBAR
Messrs. Jennings & Fox (Mombasa) Ltd.
Kilindini Road, P.O. Box 56, Mombasa, Kenya.

COMPONENTS—SURPLUS AND SECONDHAND

AMATEURS, dealers servicemen why pay fancy prices? "Be in the know." Send s.a.e. today for list that will save you pounds; goods c.w.o. only; money back guarantee; don't delay! No c.o.d. ANNAKIN, 25, Ashfield Place, Otley, Yorks.

MAZAK sockets for SCR.522, 10H/402-404-419 at 1/6; 10H/414 (6-way), 10H/416 (12-way), at 2/-; 10H/417 and 418 (18-way), at 2/6; new, boxed; power units for W/S.19 Mk. 11, new condition, 27/6 each; SCR.522—most sought after v.h.f. set, good condition, T/R with valves, in case, nothing missing, £12 each, only few left; postage 6d under 15/-. GILFILLAN & Co., 52, South St., Worthing, Sussex. Tel. Worthing 3127. [6733

SPOTLESS surplus components offered by Radio Unlimited, Elm Rd., London, E.17. Tel. Key. 4813.—80 ohm co-ax., 10/- doz yds; Thytron valve VT109, 5/-; guar. P.M. speakers 2½in, 13/6, 3½in, 14/6, 5in, 15/-, 6½in, 13/6, 8in, 16/-, 10in, 19/-; pentd. o/put trans., 5/11; condensers 8mf 450v, 2/9, 8×16 450v, 3/9, 16×16 450v, 4/3, 32mf 350v, 2/9; pre-amp chassis, with two int/oct hldrs, and good assortment Rs and Cs, 5/6; midget I.f.ts, 10/6 pair; chokes 7H, 60 m/a, 5/9; mains trans. 350-/-350, 6v, 5v, tapped at 4v, 17/6; V/controls, guar. semi-midget values 10K to 2 Meg, L/sw, 4/-; 8P, 5/9; DP, 6/6; Egam 10K to 2 Meg, L/spindle, L/sw, 3/-, W/sw, 4/6; special offer, 10K, ½ and 1 Meg. controls L/spindle, W/sw, 3/9; ½ Meg., ¼in spindle, L/sw, 1/6; B9G V/hldrs., 3/- doz.; Int/oct, amph, 7/- doz.; 0-500 Microamp meters, 6/6; hundreds other component bargains; stamp list. [0062

G. A. RYALL, "Utopia," Mayfield Rd., Herne Bay, Kent, offers post-free bargains, all new and unused; metal instrument boxes with ¼in Paxolin panels, size 8½×7½×3½in deep, 4 fixing lugs for wall or bench, 6/9 each; instrument switches, miniature SB.2P 3-way, 1/3 each, and standard Yaxley type, SB.8P 9-way, 1/3 each; and 2B.8P 6-way, 1/6 each, and 3B.2P 6-way, with total 5 poles, 2/- each; meters 0-50ma, 2½in (1¾in overall), 5/9 each; and 2in square front, 0-300v (5ma), 5/9; best make, 2in. 0-5ma, fine open scale, 7/9 each; high resistance headphones, sponge rubbers, padded headbands, with good class carbon microphone, all wired into large 4-cleft plug, as per R.A.F. adverts, used but good condition, 5/9 set; Paxolin panels, ½in, 12×12, 4/10, or slightly marked or bad colour, 2 for 5/10; 12×8 ditto, short strips, Govt. quality, ¾in thick, approx. 12×5in, 1/9; and ¼in terminal strips, 2ft×1¼in, 1/4, condensers, 4mf Mansbridge upright feet, terminals, 2/3; 1mf ditto, 2 for 1/3; 400v wkg, mica, 0.01mf tags, 6, 1/3; 350v, 0.001mf ditto, 0.004mf, 1,250v wkg., 6 1/9; insulation of all condensers perfect; single wound H.F. chokes, small, as used motors, etc., per pair 1/3; 4 new resistance panels, with 29 ⅛/¼/1/2-watt colour coded, best make carbon resistances, Nos. 5/4/14/18, at 4/6 lot; and No. 15 panel with Ceramicon 20mm, 40mm, 80mm, 100mm and ditto in mica, 2 for 1/4; pairs of 25mf 50v electrolytics, 1/9; miniature red lamp holders, with bulb and cap complete, 1/6; 7ft twin screened cable, in 2 lengths, suitable radio 1/4; 18ft twin rubber cable, light gauge, in 2 lengths, 1/4; 2-way plug and jack, 1/3; single ditto, bakelite toggle switches, 2P.ST, 1/3, and 2B.ST, make-over, 1/6; and 2½in pointer knobs, 1/3; 4-gang condensers, 0.0004mf, straight type, brand new, 3/10 each; twin gang ceramic butterfly, 10mm, 2/9; heavy duty L.T. resistances, 2 tags, 8 ohms, 1/6; vitreous 25 ohms, tapped, 1/3; and ditto 3.5 ohms, 1/3; vitreous 500 ohms, about 15w, with clips, 1/6 [0205

NOTICES

BRITISH SOUND RECORDING ASSOCIATION. THE 1950-51 Lecture Session has been most successful and will terminate with a repetition of our 1950 exhibition; this will be the outstanding event of the year and full information will be available to all interested; membership of the Association is essential to all actively engaged or keenly interested in high quality sound recording and reproduction; a few copies of the journal are available to non-members, price 2/9 p.f.; copies of the revised Publications List P.103 are available as also is the new brochure giving full information of the work of the Association and the benefits conferred by membership; the foregoing, with a Membership Application Form, may be obtained from the Membership Secretary, Harrie J. King, 44, Mount View Rd., North Chingford, London, E.4. [0119

WANTED, EXCHANGE, ETC.

WEARITE tapedeck wanted, new or used, perfect.—Box 0704. [6761

FEW Magnetron permanent magnets, state size and price.—Box 7994. [6397

WANTED, Magnetophon Tone B, with spares (amplifier not required).—Box 2665. [0198

EXCHANGE modified R1155, power-pack and output included for amplifier.—Box 0639. [6737

WEARITE tape-deck urgently required, any offer considered, top price paid.—Box 0747. [6781

WANTED, dynamometer a.c. test set, also oscilloscope type 339A, also L050A oscillator. LESLIE DIXON & Co., 214, Queenstown Rd., Battersea, S.W.8. Macaulay 2159. [0176

WANTED, dynamotors, 24v in., 500/600v at 200ma out., approx.—Matheson, Fishmarket, Aberdeen. [6759

WANTED, "The Broadcaster, Serviceman's Manual, April 1937, Vol. IV; good price paid.—Box 0758. [6791

WANTED, convertor for television, 50 volts input, new or secondhand.—Bates, Buncefield, Hemel Hempstead. [6731

DUAL DRIVE WITH BUILT-IN CROSS-OVER AND FEED-BACK IN ONE UNIT

A Barker sound unit is just that! The moment you see it you realise it is different from the conventional loudspeaker. It is a laboratory built unit with an individuality and quality which can only be achieved by personal care at every stage of its making.

The heart of things is the patent drive consisting of a featherweight aluminium tube on which is wound a coil of aluminium wire over a sleeve of pure latex. This gives a true dual drive covering the full audio frequency range. At the lower end, coil and former move together; then the latex starts to flex increasingly until it allows the former to drive alone up to the supersonic region by induced currents from the coil. This is a true, matched cross-over.

At all frequencies, a critical self adjusting feed-back effect arises from reverse currents generated in the former by its movement in the powerful magnet field. This feature, exclusive also to Barker drives, gives that control of the entire system which results in precise detail and attack; ironing out of resonances; smoothness; naturalness and pleasing quality which make Barker sound units indeed.

BETTER THAN TWINS.

Send a p.c. for full details, to:—

BARKER NATURAL REPRODUCERS,

BCM/AADU,

LONDON, W.C.1.

THE "FLUXITE QUINS" AT WORK

"Well done, m'lad! What a brain!
A new 'guided-missile', that's plain."
Yelled EH "Far from right
Our set needs FLUXITE,
For there goes our cathole again!"

See that **FLUXITE** is always by you—in the house — garage — workshop — wherever speedy soldering is needed. Used for over 40 years in Government works and by leading engineers and manufacturers. Of all ironmongers—in tins from 1/- upwards.

TO CYCLISTS! For stronger wheels that will remain round and true, here's a time tested tip. Tie the spokes where they cross with fine wire AND SOLDER. It's simple — with FLUXITE — but IMPORTANT.

The **FLUXITE GUN** puts **FLUXITE** where you want it by a simple pressure. Price 2/6, or filled, 3/6.

FLUXITE

SIMPLIFIES *ALL* SOLDERING

Write for Book on the Art of "SOFT" Soldering and for leaflet on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE. Price 1d each

FLUXITE LTD. (Dept. WW), BERMONDSEY STREET, LONDON, S.E.1.

NEW ELECTRONIC SUPPLIES Co.

281 LEEDS ROAD, FAGLEY, BRADFORD, YORKS

MAIL ORDER ONLY

Primaries 200/250. Varnish impregnated. **New goods only.** S = drop through. F = fully shrouded. W.F. = skeleton finish, upright. Special quotes 48 hours. **Stamp, please.** C.W.O. carriage paid.

S361. 250-0-250 v. 75 m/a., 6.3 v. 3 a., 5 v. 2 a.	18/11
***F350.** 350-0-350 v. 90 m/a.	21/3
***S350.** 250-0-250 v. 110 m/a.	23/11
***S300.** 300-0-300 v. 110 m/a.	24/11
***S351.** 350-0-350 v. 110 m/a.	26/11
Above marked * have L.T.s 0-4-6.3 v. 4 a., 0-4-5 v. 2 a.	
S315. 350-0-350 v. 160 m/a., 6.3 v. 3 a. C.T., 5 v. 3 a.	29/11
F315. 350-0-350 v. 160 m/a., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a.	43/9
***F350.** 350-0-350 v. 90 m/a.	22/3
***F250.** 250-0-250 v. 110 m/a.	24/11
***F300.** 300-0-300 v. 110 m/a.	25/11
***F350.** 350-0-350 v. 110 m/a.	27/11
Above marked * L.T.s 0-4-6.3 v. 4 a., 0-4-5 v. 2 a.	
W.F.1. 260-0-260 v., 70 m/a.	14/3
W.F.2. 300-0-300 v., 70 m/a.	15/3
W.F.3. 350-0-350 v. 70 m/a.	17/6
Above 3 L.T.s 6.3 v. 2 a., 5 v. 2 a.	
W.F.4. 350-0-350 v. 80 m/a.	19/11
W.F.5. 260-0-260 v. 90 m/a.	19/11
W.F.6. 350-0-350 v. 90 m/a.	20/11
Above 3 L.T.s 6.3 v. 3 a. 5 v. 2 a.	
S3615. 350-0-350 v. 150 m/a., 6.3 v. 4 a. C.T., 5 v. 3 a.	29/8
F3615. 350-0-350 v. 150 m/a., 6.3 v. 4 a. C.T., 5 v. 3 a.	32/9
S205. 250-0-250, 100 m/a., 6.3 v. 6 a., 5 v. 3 a.	27/9
F205. 250-0-250, 100 m/a., 6.3v. 6 a., 5 v. 3 a.	29/11
Williamson mains F.625. 425-0-425 v. 200 m/a., 6.3 v. 4 a. C.T., 6.3 v. 4 a. C.T., 5 v. 3 a.	52/11
Williamson Amplifier Components below :—	
Pre-amp. Mains. F.325-0-325, 20 m.a., 6.3 v. 1.5 a., 6.3 v. 0.6 a.	21/11
C.K.8. 50 H. 50 m/a., 1,500 ohms.	21/11
C.K.9. 10 H. 150 m/a.	29/11
C.K.10. 30 H. 20 m/a.	18/-
W.F.C.11. 8 H. 110 m/a.	14/11
All above very heavy jobs, generous design.	

WANTED, EXCHANGE, ETC

KLYSTRONS, Govt. surplus wanted; quantities only, all types.—Wilho Products, Ltd., 216/222, Gorbals St., Glasgow, C.5. [6750

AR88D or LF receiver; good price for one in good as new condition; write full details; will inspect and collect it not too remote.—Box 0643. [6749

WANTED HRO coils, Rxs, etc. AR88s, BC348s, 827s, etc.—Details to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0163

WANTED, laboratory test equipment including standard signal generator, watt meter, oscilloscope, bridges, recorders; send price and details to:
HATFIELD INSTRUMENTS, 175, Uxbridge Rd., Hanwell, W.7. Tel. Ealing 0779. [0037

WANTED, set manufacturers' or ex-Government radio equipment, large or small quantities of valves, electrolytics, speakers, meters, also components.
LOWE BROS., 199, Mile End Rd., London, E.1. Ste. 2579. [6554

WANTED, all types of radio equipment, test instruments, radio receivers, personal sets, television, components, etc., etc.; call, write, send or 'phone.
MILLER'S RADIO, 38a, Newport Court, Charing Cross Rd., London. [5211

WANTED, surplus relays, impulse switches, sparking plugs, 5-way, push-button units; any condition; large or small quantities; highest prices paid.—Box 4660. [5579

WANTED, Antenna tuning units type BC-939-A and T-50 microphones and junction boxes JB-70A.—PCA Radio, The Arches, Cambridge Grove, W.6. Tel. Riv. 5279. [0167

WANTED, RCA speech amplifiers type MI-11220 J or K and telephones type EE8; offers stating quantity and price to—PCA Radio, The Arches, Cambridge Grove, W.6. [0093

WANTED, BC-610 Hallicrafters transmitter, SX-23; AR-88's HRO receiver and spare parts for above; best price.—Write Box 864, c/o Sell's Service, 69, Fleet St., London, E.C.4. [0090

WANTED, working instructions manual for S+D.X. (Marg 2) and Terminal Corner Telephone (1+4).—Pankhurst, Northamptonshire Newspapers, Ltd., Dryland St., Kettering. [6705

WANTED, AN/APR-4 receiver, any units; any other good quality U.S. surplus radio and radar, tubes, test sets; laboratory equipment, etc.; give condition and price in first letter.—Littell, Farhills, Box 26, Dayton 9, Ohio, U.S.A. [8346

REPAIRS AND SERVICE

THE Timing Division of CAMERER Cuss and Co., undertakes the repair, calibration and, if required, National Physical Laboratory Certification of all types of STOP watches, chronographs, complicated watch mechanisms and TIMING devices. A comprehensive stock is also available, to suit every requirement.
CAMERER CUSS & Co., 56, New Oxford St., London, W.C.1. Tel. Museum 4861. [6723

MAINS transformers rewound, new transformers to any specification.
MOTOR rewinds and complete overhauls: first-class workmanship, fully guaranteed.
P.M. ELECTRIC Co., Ltd., Potters Bldgs., Warser Gate, Nottingham. Est. 1917. Tel. 3895.

LOUDSPEAKERS repaired promptly, any make.—Model Loudspeaker Service, 34a, Bullingdon Rd., Oxford. [6519

MAINS transformers rewound or constructed to any specification; prompt delivery.—Bede Transformer Co., Ltd., Bedesway, Bede Trading Estate, Jarrow. [3196

REPAIRS to moving coil speakers cones; coils fitted, field rewound or altered; speaker transformer, clock coils rewound; guaranteed satisfaction, prompt service.
L.S. REPAIR SERVICE, 49, Trinity Rd., Upper Tooting, London, S.W.17. Balham 2359. [0110

AISH rewinds, no delay transformers, mains, TV. output, chokes, also to your specification; vacuum impregnation, interleaving, new tag panels; our aim—your satisfaction.
AISH & Co., Ltd., Vanguard Works, Poole, Dorset [6573

REPAIRS.—E.H.T., mains and O.P. transformers, field coils and chokes; also armatures and motors; new transformers designed to any specification; all work fully guaranteed.
WILLESDEN TRANSFORMER Co., Ltd., 20a, Church Lane, Church Rd., N.W.10.

RADIO MAINTENANCE SERVICE for guaranteed rewinds and repairs; armatures, F.H.P. motors, vac. units, portable tools, etc.; good deliveries.—139, Goldhurst Terrace, N.W.6. Mal. 6133. [9925

"SERVICE with a smile."—Repairers of all types of British and American receivers; coil rewinds; American valves, spares, line cord. F.R.I., Ltd., 22, Howland St., W.1. Museum 5675. [0112

ELECTRICAL measuring instruments of every make, multi or single range, repaired and standardised; prompt attention.—The Electrical Instrument Repair Service, 329, Kilburn Lane, London, W.9. Tel. Lad 4168. [3715

24-HOUR service, 6 months' guarantee, any transformer rewind, mains outputs and i.f.s., etc.; all types of new transf., etc., supplied to specification; business heading or service card for trade prices.—Majestic Winding Co., 180, Windham Rd., Bournemouth. [6520

METROPOLITAN RADIO SERVICE for rewinds mains and E.H.T. transformers, chokes and field coils; new transformers designed and manufactured singly or in quantities.—Metropolitan Radio Service Company, 1,021, Finchley Rd., London, N.W.11. Tel. Speedwell 3000. [0130

WILCO ELECTRONICS

RECEIVER R.1155. One of the best communication receivers covering 7.5 Mc/s to 75 Kc/s in 5 wavebands, complete with 10 valves. Brand new in maker's transit case, **£10/10/-.** Carriage 7/6. Others not so clean, from **£8/10/-.**

AIRCRAFT CLOCKS with splendid 8-day jewelled movement, flange type, made to stringent Govt. specification. Brand new, guaranteed. Ideal for car study, bedroom, etc., will withstand vibration and shocks. Special offer, **65/-** each. Post free.

POWER PACK, Type 3. for R1132A receiver. Brand new, in perfect condition. Input switched 200 to 260 volts, A.C. 50 cycle, with two smoothing chokes, fitted D.C. voltmeter 0-300, milliampere meter 0-150, fuses etc. A superb job, **£4/19/6.** Pkg. and Cge. 10/-.

TEST SET, Type 38. Incorporating a 50 Microamp meter, in steel case 6in. × 3¼in. × 3in. with carrying handle. **50/-.**

MICROPHONES. Moving coil type 40216 S.T.I., make. Brand new, high fidelity dynamic, omni-directional, impedance 15 ohms, one of the finest available offered at **£4/17/6.** Cge. and Pkg. 2/-, which is a fraction of their original cost.

POWER UNITS. Comprising standard mains transformer, 350-0-350 volts 80 M.a., 6.3 volt 1 a., 6.3 volt .5 a.,5 volt 2 a., L.F. choke, 8 + 8 Mfd. condensers, 5Z4G valve etc., contained in steel case 9in. × 8¼in. × 6in., sufficient room to build in small amplifier. Brand new **£2/10/-**, carr. and pkg. 2/6.

SIGNAL GENERATORS. 1.72 J. Ex-U.S.A., range 100 kc. to 32 Mc/s in five ranges, 400 cycle modulation, output 30,000 microvolts, in metal cabinet. Crackle finish with carrying handle, for 110-125 volts A.C. operation. Brand new, unused **£19/10/-.**

OSCILLOSCOPE UNIT. W7566 in steel case 9¼in. × 17in. × 21in. by Marconi. Containing mains transformer, 2,500 volts at 5 M/a., 4 v. at 2 amp. Smoothing condensers, 2—.5 Mfd. 4,000v. wkg., 1—.5 Mfd. 1,500v. D.C., 1—2 Mfd. 500 v. D.C. Tube holder for VCR97. Mu-metal screen etc. Brand new. Bargain Price **£5.** Cge. and Pkg. 10/-.

204 LOWER ADDISCOMBE ROAD, CROYDON

AUDIGRAPH DEMONSTRATE—

TAMSA

TAPE RECORDING EQUIPMENT at: THE BRITISH SOUND RECORDING ASSOCIATION EXHIBITION—

May 19th and 20th, Waldorf Hotel, Aldwych, London, W.C.2

Write for Latest Price List of:—
MAGNETIC RECORDING COMPONENTS, CONSTRUCTOR'S ENVELOPES and BOOKS.

AUDIGRAPH LTD.

Dept. MR3, 74, Great Hampton Street, HOCKLEY, BIRMINGHAM 18

MANUFACTURERS—We hold large stocks of components and can offer Immediate Delivery of many components that are in short supply. Send us your enquiries or 'Phone Luton 2677.

Express Delivery from

COVENTRY RADIO

189, Dunstable Road, Luton

VALIDUS

CREATE A NEW AND HIGHER CLASS IN ECONOMY TELEVISION WITH THE LATEST RANGE OF

AERIALS
PRE-AMPLIFIERS
CABLE
ACCESSORIES
DISTRIBUTOR
BOXES ETC.

LONDON. BIRMINGHAM. HOLME MOSS

Apply for full information

VALIDUS AERIALS

69 HORNSEY ROAD, LONDON, N.7

North 4574

MAGNETIC TAPE

Recording Equipments and Components

OSCILLATOR UNIT. Constructed on small chassis suitable for sub-assembly, provides r.f. for erase and bias at 45 kc/s. Requires 250 v. h.t. and 6.3 v. for operation. Complete with 6V6 valve, £3.

OSCILLATOR COIL ASSEMBLY. Comprises high "Q" coil and condenser tuned to 45 kc/s. Specially designed to provide highly symmetrical sine wave output for low tape noise 10/6.

RECORD/REPRODUCE HEAD. Impedance: 100 ohms at 1 kc/s. High quality response. Totally enclosed. Gap length 1 mil., £2/2/-.

REPRODUCE HEAD. As above, but gap length 0.5 mil. (suitable for 2-head systems), £2/2/-.

ERASE HEAD. Capable of erasing new high coercive force tape when used with oscillator unit above, £2/2/-.

TAPE. New high coercive force tape suitable for high fidelity recording at slow speeds. 7in. (1,200ft.) reels, £1/10/-. Spare reels, 7in., 4/6 each. 11in. (1,000 metre) reels also available.

INPUT TRANSFORMER. Ratio 1/40. Frequency response . ± 2 db. 50 c.p.s.—20 kc/s. Suitable for head to grid step up. Mumetal core, 17/6.

TRANSFORMER. As above, but fitted in 16 S.W.G. mumetal screening can, 30/-.

Send for further details including circuits. Trade and export enquiries invited.

CABOT RADIO COMPANY LIMITED

Electronic Equipment Manufacturers

28 BEDMINSTER PARADE, BRISTOL, 3.

Telephone 64314

WORK WANTED

WINDING and light assembly capacity available.—Competitive quotes from Labgear, Ltd., Cambridge. [6526

ELECTRONIC assemblies, long or short runs. Government or commercial.—T-H Products, 92, Leathwaite Rd., London, S.W.11. Tel. Batt. 4889. [6530

DRAUGHTING, tracing and photoprinting services; estimates free; contractors to the Ministry of Supply and the Admiralty for drawing and tracing work to their requirements and specifications; sub-contracting work of this nature undertaken.

DRAWING & TRACING, Ltd., 456a, Ewell Rd., Tolworth, Surbiton. Tel. Elmbridge 7406. [5975

J. MORT, B.Sc., A.M.I.E.E., offers to the trade and amateur a service of technical advice, design and construction of special test gear, receivers and other apparatus, including correction of faults in home-built apparatus.—J. Mort, BCM/HIFIDEL, W.C.1. [5752

SOLVE your staff problem by letting us produce your radio or electrical assemblies and developments of any type of electronic apparatus; our machine shop and tool room also at your disposal for small or large runs, highly skilled staff; we collect and deliver if desired.—Box 0098.

MISCELLANEOUS

METALWORK; all types cabinets, chassis, racks, etc., to your own specifications. PHILPOTT'S METAL WORKS, Ltd. (G4BI), Chapman St., Loughborough. [6472

WALNUT radiogram cabinets, stamp leaflets.—Cabinetware, 1a, Heyes St., Blackburn.

RADIOGRAM and television cabinets to specification.—A. A. Cranston, 20a, Lorrimore Buildings, Olney Rd., Wandsworth, S.E.17. [6763

ELECTRONIC organ construction data, component values, practical layout, etc.; further details.—C.S. Co., 10, Duke St., Darlington.

WALNUT cabinets for Viewmaster, superb design, components for Viewmaster and E.E. televisor in stock; s.a.e. for list.—Wimble, 24, Culrose St., London, W.1. [6787

WANTED, indexes for W.W. 1944, 1945, 1946, 1947, and copies March, April, May, June and index 1941, or complete volume.—Aldred, 51, High St., Gorleston, Norfolk. [6764

SHEET metalwork; chassis, cabinets, instrument cases, etc., made to your own specification; prototype and one off a speciality.—Beaucaire Metalworks, 30, Beauclerc Rd., London, W.6. [6775

FLEXIBLE P.V.C. display banners, all colours, indelibly silk-screened, no cotton stitching. All seams high frequency welded. Inquiries to The Lithographic & Printing Co. Tel. Weybridge 3585. [6788

ENGRAVING amateurs and trade could take the opportunity of engraving problems in the future by getting in touch with A. G. Engraving, 19a, Windmill Rd., London, S.W.18. Brass, bronze, erinoid, perspex dials; one knob or repetition equally entertained. [0054

ALLSCREWS, Ltd., for B.A. screws, nuts, washers, studding, grub-screws, bolts, soldering tags, woodscrews, etc., plain or nickel or cadmium plated, one-gross packets or large quantities; stamp for lists.—270a, King St., Hammersmith, W.6. Riv. 7762. [5426

COPPER wires enamelled, tinned, Litz, cotton & silk covered, all gauges; B.A. screws, nuts washers, soldering tags, eyelets; ebonite and laminated bakelite panels, tubes, coil formers, Tufnol rod; headphones, valves, etc.; latest radio publications, full range available; list, s.a.e.; trade supplied.—Post Radio Supplies, 33, Bourne Street, London, S.W.1. [0138

ELECTRIC clocks, 200/250v AC, brand new, 27/6; mercury vapour rectifiers, 1,000v, 600ma, 4v heater, 8/9; fuse boxes, to hold 6 pairs of fuses, with set of spare fuses, with 5, 10 or 15amp, 8/8; back copies of "Wireless World" sent to anybody, 2/6; car battery chargers, 6v, 1amp, for 200/250v a.c., complete with clips, fuse, pilot lamp, 34/9.—Maiden Transformer Supplies, 200, Cambridge Rd., Kingston-upon-Thames. [1038

SITUATIONS VACANT

ELECTRONIC mechanics.

WANTED for employment in various establishments of the Ministry of Supply, craftsmen experienced in the installation, operation, repair and maintenance of radio, radar, signal, fire control and other electronic equipment; applicants must have had wide experience of such work.

WAGES according to skill and experience from 139/- to 155/-, with opportunities for advancement up to 173/6 (London), 171/- (provinces) for 44-hour 5-day week.

Applications, giving full particulars of age, apprenticeship, training, experience and qualifications, to Assistant Director, T.P.A.2, Ministry of Supply, Ivybridge House, John Adam St., London, W.C.2. [6796

ELECTRONIC development engineers; vacancies exist for:—

(1) SENIOR DEVELOPMENT ENGINEER to be responsible under technical director for the development and design of a wide range of C.R.O. and associated electronic equipment; applicants must have an Hons. Degree in Physics or Electrical Engineering (Telecommunications) and some industrial experience; first-class opportunity for a man with original ideas and a keen interest in the subject.

(2) DEVELOPMENT ENGINEER for work on interesting development projects; a degree in Physics or Electrical Engineering is essential and some industrial or research experience desirable; salaries according to age and qualifications.—Apply with full details to Southern Instruments, Ltd., Fernhill, Hawley, Camberley, Surrey.

RADIO and television fault finders and testers urgently required.—Ferguson Radio Corp., Ltd., Gt. Cambridge Rd., Enfield. [6726

SURPLUS BARGAINS

MANUFACTURERS' & BANKRUPT STOCKS

LIMITED SUPPLIES ONLY

We can offer for immediate delivery

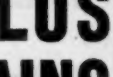
JUST IN!

PURCHASED-FURTHER STOCK

—DIRECT FROM M.O.S.

STORAGE & STARTER BATTERIES

6v. 72 amp. "E.S.E."
6v. 85 amp. "E.S.E."
6v. 90amp. "Reading" USA
6v. 100 amp. "Delco Remy"
6v. 140 amp. "Delco Remy"



All brand new in original cases.

90 and 100 amp. with wing nuts.

Receivers: R1155, 1355 and 184 Brand New in original cases. Dinghy Radio Transmitter SCR 570.

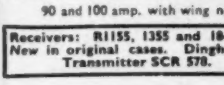
EX-W.D.

AERIALS

CAN ALSO BE USED AS

FISHING RODS

12 ft. Steel Aerials (3 sections of 4 ft.)



MAKE IDEAL FISHING RODS

Charging Control Boards with Auto. cut out, 3 amp. 229 v.

2 Volt Accumulators, suitable for Radio or Model Driving, House Lighting, etc. Heavy Mass Type Plates. Pre-charged. **Only need filling.** Size: 7in. x 2in. x 2in.

Magnifying Lenses, Rubber Masks, Burgoyne Solder Guns, Bakelite Accumulators. Ex-Govt. S.W. Condensers. All types. Meters, Switches, Toggle and Yaxley. Headphones, L/R and M/R. Vibrators, 6 and 12 v. Speakers all types. Volume Controls. Output Transformers. Chokes. Crystals—Valves Type CV.101.

Your enquiries are invited

WHOLESALE AND EXPORT ONLY

For further bargains call at our Counter or write for new bulletin.

(Please quote Dept. W.W.)

RADIO MERCHANDISE

COMPANY LIMITED

65, Farringdon Road, London, E.C.1.

Telephone: HOLborn 6377.

Cabinets of Distinction . . .

RADIOGRAM CABINETS
RECEIVER CABINETS
RECORD CABINETS
DRAWER UNITS

Catalogue available on request.

Chassis

A.C., 5-valve 3 w/b Superhet Radiogram chassis. Absolutely complete kit of parts including wiring diagram . . . . **£10 . 10 . 0**

Or fully wired and tested . . . . . **£12 . 5 . 0**

Amplifiers

Four to fifteen watts output. Wired, or in kit form from . . . . . **£3 . 19 . 6**

Full details of above available on request.

LEWIS RADIO CO.
(DEPT. 551), 322, HIGH ROAD, WOOD GREEN, LONDON, N.22
Telephone . . . BOWes Park 5997

LOCKWOOD
makers of
Fine Cabinets
and woodwork of every description for the Radio and allied trades
LOCKWOOD & COMPANY
Lowlands Rd., Harrow, Middlesex. Byron 3704

Come to
SMITH'S *of* **EDGWARE ROAD,**
the friendly shop,
for all radio components

We stock everything the constructor needs—our 25 years' experience of handling radio parts and accessories enables us to select the best of the regular lines and the more useful items from the surplus markets in :—

Loudspeakers & Phones	**Capacitors & Resistors**
Transformers & Chokes	**Coils & Formers**
Meters & Test Equipment	**Plugs & Sockets**
Pickups & Turntables	**Aerials & Insulators**
Switches & Dials	**Meters & Generators**
Metalwork & Bakelite	**Wires & Cables**
Books & Tools	**Panel Lights & Fuses**
Valve Holders & Cans	**Sleeving, Nuts & bolts,**
Metal Rectifiers	**Tags, Clips, Grommets &**
Cabinets & Cases	**all other bits and pieces**

NOTHING TOO LARGE—NOTHING TOO SMALL

We have one of the largest stocks of B.V.A. Valves & C.R.Ts.
(No general catalogue available.)

H. L. SMITH & CO. LTD.
287/9, EDGWARE ROAD, LONDON, W.2
Tel.: Paddington 5891. Hours 9 to 6 (Thursday, 1 o'clock)
Near Edgware Road Stations, Metropolitan and Bakerloo.

SITUATIONS VACANT

ROYAL Air Force—Education Branch.

PERMANENT and short service Commissions. APPLICATIONS are invited for permanent commissions (age limit 25-35 years) or for short service commissions for 3, 4 or 5 years (minimum age 21 years); university graduates in physics, engineering (mechanical, aeronautical, electrical, electronic or radio) or mathematics are mainly required; candidates for permanent commissions should ordinarily be first- or second-class honours graduates in one of these subjects; pay on appointment depends on qualifications, experience and war service, thus a first-class honours graduate, aged 25, may receive pay of £529 a year and, if married, marriage allowance of £338; single officers receive free furnished accommodation; all officers draw rations in kind, or a tax-free allowance of £60 a year in lieu; there is time promotion to Squadron Leader, in which rank, pay and marriage allowance rise to £1,232 a year (plus rations or ration allowance), promotion to Wing Commander and higher rank is by selection; retired pay for permanent officers varies with rank (e.g., £625 for Wing Commander, £825 for Group Captain); some short service officers will be selected annually for permanent commission, those not so selected receive a gratuity on completion of service; short service in the education branch can be treated as contributory for teachers superannuation purpose.
WOMEN'S Royal Air Force.
VACANCIES exist for education officers on permanent and short service commissions; qualifications and conditions as for men except that pay rates are about three-quarters and retired pay rates about two-thirds of those for men; free furnished accommodation and rations are provided.—Full details and application forms for all the above appointments from Air Ministry, A.R.1., Kingsway, London, W.C.2. [6589

CROWN AGENTS OR THE COLONIES.

ELECTRICAL engineer (electronic) required for the Headquarters Staff at the London office; salary scale £750 a year rising to £1,000 a year; extra duty allowance of 8 per cent of annual salary also payable at present. Engagement will be on unestablished terms with a prospect, after satisfactory service, and as vacancies occur, of appointment to the established and pensionable staff and promotion to a higher grade. Candidates should preferably hold an honours degree in electrical engineering (telecommunications and electronics) or be corporate members of the Institution of Electrical Engineers. They should have served an apprenticeship with a firm of electrical engineers manufacturing radio or associated equipment and have had subsequent experience on the manufacturing and technical side of the industry. The appointment will in the first instance be to the Inspection Department, and candidates should be capable of dealing with the problems arising from the inspection of a wide variety of electronic equipment by a staff of inspecting engineers.—Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M.28544.B, on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. [6793

WOOLWICH POLYTECHNIC, LONDON, S.E.18.

THE Governing Body invite applications for the post of lecturer in Physics from men or women who possess Honours Degrees in Physics. Candidates should be prepared in the first place to teach Physics to the standard of the London Intermediate B.Sc. Examination. Opportunities for more advanced teaching may arise.
BURNHAM Technical Scale salary: £300—£15—£555, plus London allowance of £36—£48, plus the following where applicable: (i) Graduate allowance £50 above minimum and maximum; (ii) First-class Honours Degree—£15 above minimum and £30 above maximum; (iii) Training allowance £15 for each year, up to three, for full-time study or training beyond two years—above minimum and maximum; (iv) increments for industrial experience up to 12 years above minimum; (v) increments for full-time teaching experience.
THESE scales will be revised as from 1st April, 1951.
FULL particulars of the post and application forms may be obtained from the Clerk to the Governors to whom they should be returned not later than 10th May, 1951. [6785

BERRY'S (SHORT WAVE), Ltd., have vacancies for counter sales assistants, good radio knowledge essential.—85, High Holborn, W.C.1. [6748

BERRY'S (SHORT WAVE), Ltd., has vacancies for counter sales staff having good technical and business experience.—85, High Holborn, W.C.1. [6607

EXPERIENCED Recording Engineer for direct disc and tape recording; salary £400 plus bonus.—Apply John Shinn & Sons, Ltd., Market St., Leigh, Lancs. [6701

ELECTRONIC Testers required for firm manufacturing instruments and servo mechanisms in West Country; housing available; interviews in London area.—Box 0627. [6707

EXPERIENCED Radio Mechanics required by Messrs. S. Smith & Sons, Radiomobile, Ltd., at their Great West Road factory, Brentford.—Apply personally to Personnel Officer.

RADIO service engineer or good class radio wireman required by old established firm in London area; permanent job.—Apply to E.M.G. Hand-made Gramophones, Ltd., 56-58, Rochester Place, London, N.W.1. (Gulliver 5256.) [6782

M. & J. PEARSON
263, GALLOWGATE, GLASGOW, C.4.

Offer the following Clearance Lines.

Hoover Electric Motors. Brand new but store soiled, 220-230-250 volt 50 cycles, single phase, 1/6 h.p., 1,425 revs. Anti-vibration mounted on flange 6in. x 6in. Spindle 1¼in. x ½in. Every motor offered on money-back guarantee if not thoroughly satisfied. **£4/4/0** each.

Control Unit Type 203. 12in. x 9¾in. x 3in., and contains the following. Two 6-pole 2-way Yaxley switches with knobs, red dome panel indicating lamp, toggle switch, two jack sockets, Westinghouse rectifier, 12 volt 1.5 amp. full wave, microphone transformer, smoothing choke, two 1,000 mfd. 25 volt metal cased condensers, P.O. relay 1,000 ohm coil and Siemens high-speed relay with two 1,000 ohm coils, terminal strips, etc. Brand new in cartons. Price **12/6** each.

Sperry Bombsight Computor, contains 100 various precision gears, spirals, levels, worm drives and variable pitch worm gear, gyro unit, servo syphon unit, 2-24 volt motors, with pulley shafts and reversing clutch mechanism. Selsyn 24-volt repeater motor and many other useful parts.

Brand new in transit case, **£2 10 0.**

All orders carriage paid Scotland and England

The VOIGT Loudspeaker is still ahead of all others. P.M. Unit with 22,000 line gap flux **£40** ex Works.
Corner Horns (in the white) **£19 - 10 - 0** or **£47 - 10 0** ex Works.
Home demonstrations arranged in London area.
Order from
VOIGT PATENTS LTD.
Sydenham, S.E.26 *Syd 6666*

CHASSIS

HAYES RG/12G RADIOGRAM CHASSIS. The demand for this attractive and popular chassis increases month by month. The total price of **£13/7/6** includes an 8in. loudspeaker, representing real value-for-money in these days of rising prices. A 10in. L.S. can be supplied at a slight extra cost. Fully guaranteed for one year. Full details will gladly be sent you by return of post.

ARMSTRONG CHASSIS. We hold the largest stocks of Armstrong chassis in the Midlands, and are the sole Birmingham agents. The full range as shown on page 97 can be seen and heard in our showroom. Open all day Sats.

THE HAYES COMPANY
1 ALCESTER RD., MOSELEY, BIRMINGHAM 13
Phone : SOUTH 0202

PITMAN

Telecommunications Principles

By R. N. Renton, A.M.I.E.E. A new work covering the syllabus for the City and Guilds Examinations in Telecommunications Principles, Grades I, II, III. Illustrated **37/6** net.

Fundamentals of Radar

By Stephen A. Knight, F.R.S.A. A useful book surveying the principles underlying radar. It is of special interest to radar operators and students, as well as those engaged in the industry. Illustrated. **10/-** net.

Short-Wave Radio

By J. H. Reyner, B.Sc.Hons. A.C.G.I., etc. A reliable guide to modern developments in the use of the short, ultra-short and micro-waves. Fourth Edition. **10/6** net.

"Reliable and readable."—**Electrical Review**

PITMAN

Parker Street, Kingsway, London, W.C.2

LOWE BROS.

Can offer ex-Govt. and Manufacturers' Surplus Equipment as follows:—

Valves (Transmitting, Special Purpose and Obsolete Types), Condensers, Headphones, Meters, Crystals, British and American Receiving and Transmitting Sets, Etc. Also

40,000 Co-Axial Sockets Type 10H/701.

2,000 American Co-Axial Plugs with rubber sleeve Type 110H/584.

10,000 Jack Plugs No. ZA.5624.

20,000 Jack Sockets No. YA.7434.

10,000 Jones Sockets 4-way side entry Type 10H/425.

10,000 sets Jones Plugs and Sockets, 6, 10 way. Type 10H/264.

25,000 Telephone Jacks Type 10H/1739.

U.S. Aerial Mast Bases Type PM-48A. (60 only).

U.S. Telephone Handsets Type TS/13. (50 sets only).

40,000 Copper Plated on Steel Aerial rods. 12in. interlocking.

Litz wire by leading makers. 3/40 and 3/45. Approx. 500lb. each gauge. Other sizes shortly.

All goods open to inspection. Your enquiries cordially invited. All letters answered.

199, MILE END ROAD,

LONDON, E.1. STE 2579.

SITUATIONS VACANT

NATIONAL College of Horology & Instrument Technology.

THE Minister of Education, in consultation with the Board of Governors, proposes to appoint from 1st September 1951, a Head of the National College of Horology & Instrument Technology.

THE College is accommodated at the Northampton Polytechnic, St. John Street, London, E.C.1. The College provides for technical education and research to the highest levels in connection with the horological and the instrument making industries. The curriculum is being developed but is at present confined to a three-year General Course in Horology.

CANDIDATES for the post must have good academic qualifications and industrial experience.

SALARY scale not less than £1,100 by increments of £50 a year to £1,250 p.a.

THE post is recognised for pension purposes under the Teachers' Superannuation Acts.

A LETTER of application to include particulars of age, academic qualifications, industrial experience, and the names of three persons to whom reference may be made, should be sent to the Secretary, National College of Horology and Instrument Technology, Northampton Polytechnic, St. John St., London, E.C.1, within three weeks of the appearance of this advertisement. [6703

SKILLED tradesmen are wanted as armament artificer staff sergeants in R.E.M.E.

QUALIFICATIONS:—(i) full apprenticeship as electrical fitter, radio technician, instrument maker or motor fitter or (ii) full apprenticeship—with a knowledge of motor vehicles—as fitter, toolmaker or machinist; (iii) between 20 and 35 years of age.

WITH these qualifications you can be appointed acting sergeant in R.E.M.E. after a short period of military training (6 weeks—or less if you have previous military service); promotion to staff sergeant automatically follows a technical course on the latest types of army equipments of approximately eighteen months' duration.

PAY after 6 weeks' initial military training, 16/- a day, after 18 months' technical training, 21/6 a day; staff sergeants R.E.M.E. are eligible for promotion to warrant officer class I and commissioned rank, as electrical and mechanical assistant engineers; marriage allowance of 49/- to 52/6 a week; rations and clothing are free.

MEN engaged for 12 years which may be extended; after 22 years an armament artificer is eligible for pension.

FULL particulars from any Army Recruiting Office or write to War Office, (AG21), London, S.W.1. [6754

FERRANTI, Limited, Moston Works, Manchester, have staff vacancies in connection with long-term development work on an important radio tele-control project.

(i) SENIOR engineer or scientists to take charge of research and development sections. Qualifications include a good degree in physics or electrical engineering and extensive past experience in charge of development work. Salary according to qualifications and experience in the range of £1,000-£1,500 per annum. Please quote reference R.S.E.

(ii) ENGINEERS and scientists for research and development work in the following fields: radar, radio and electronic circuits, micro waves, high power centimetric valves, vacuum and/or high voltage techniques, servo control and electro-mechanical devices. Qualifications include a good degree in physics or electrical engineering or mechanical science, or equivalent qualifications. Previous experience is an advantage but is not essential. Salary according to qualifications and experience in the range of £420—£1,000 per annum. Please quote reference R.T.E.

(iii) TECHNICAL assistants for experimental work in the fields listed in (ii) above. Qualifications required: a degree or higher national certificate in electrical or mechanical engineering or equivalent qualifications. Salary in the range of £260—£550 according to age and experience. Please quote reference R.T.A.

THE Company has a staff pension scheme, and will give housing assistance in special cases.—Application forms from Mr. R. J. Hebbert, Staff Manager, Ferranti, Limited, Hollinwood, Lancs.

E. K. COLE, Ltd. (Malmesbury Division) invite applications from electric engineers for permanent posts in development laboratories engaged on long-term projects involving the following techniques:—

1. PULSE Generation and Transmission.
2. SERVO Mechanisms.
3. CENTIMETRIC and V.H.F. Systems.
4. VIDEO and Feedback Amplifiers.
5. V.H.F. Transmission and Reception.
6. ELECTRONICS as applied to Atomic Physics.

THERE are vacancies in the senior engineer, engineers and junior grades; candidates should have had at least 3 years' industrial experience in the above types of work, together with educational qualifications equivalent to A.M.I.E.E. examination standard. Commencing salary and status will be commensurate with qualifications and experience; excellent opportunities for advancement are offered with entry into a pension scheme after a period of service; forms of application may be obtained from—Personnel Manager, Ekco Works, Malmesbury, Wilts.

DEVELOPMENT engineers and mechanical designers for leading radio and equipment manufacturer; applicants must have extensive experience of design work on broadcast receivers, television receivers, or of communications equipment; preference will be given to applicants with experience in control of projects. —Box 0710. [6775

SUPACOILS

OFFER

THE LATEST EDITION OF THE

HOME CONSTRUCTOR'S HANDBOOK

No keen radio enthusiast should be without this invaluable booklet which is of equal use to beginner, amateur or professional radio engineer. It contains, among other things:

- Circuits of Feeder units, Superhet receivers, Test equipment, Amplifiers and power packs, etc.
- Pages of servicing and constructional information which will assist you in YOUR radio problem.
- Complete resistance colour code.
- A considerable amount of invaluable general Radio information.
- A comprehensive catalogue.
- Above all it is profusely illustrated with half tone blocks and costs 2/- only or a copy will be given **FREE** with ever order for £1 or more.

We also offer the following selection from our stocks of quality components:

- **COILS.** A complete series of High Q variable iron dust cored coils (as recommended for the P.W. 9 valver) in wavelengths 10-30, 16-50, 30-75, 75-200, 190-550 and 800-2000 metres; Aerial, H.F. or Oscillator at the remarkable price of 3/- each.
- **MODEL 30** famous 3 waveband superhet Coil Packs, aligned, 40/11 inc. full connection details and instructions given with every pack.
- **MODEL 40** Coil Packs—similar, with R.F. stage, aligned, 70/3 inc.
- **MODEL 30 TUNING UNIT** consisting of 30 Coil Pack, pair of I.F. Transformers, matched 2-gang and attractive Dial. Components aligned together as a unit and sealed. 69/9 inc.
- **MODEL 40 TUNING UNIT,** similar with R.F. stage ..... 99/6 inc.
- **CHASSIS.** Good quality aluminium chassis in stock for 5 v. Rec. 11/-; 6 v. Rec. 12/-. Amplifiers and Feeder Units, etc., from 7/-
- **SPECIAL !!** 7 pole, 4 way, 3 bank switches ..... 10/6 each
- **COIL GROUPS.** The very popular Coil Group A 26/9
  Coil Group B 43/9
- **LATEST.** Litz wound, Iron dust cored TRF COILS. H.W. only, Aerial and H.F. ..... 7/6 PAIR

See also our classified advertisement

SUPACOILS MAIL ORDER OFFICE

98, Greenway Ave., London, E.17

• **1951 EDITION** •

THE RADIO AMATEUR'S HANDBOOK

Published by the A.R.R.L.

• • • Price **22/6** postage 1/- • • •

THE MODERN BOOK CO.

21, PRAED STREET, LONDON, W.2

Tel: PADdington 4185

OPPORTUNITIES IN RADIO

Get this FREE Book!

'ENGINEERING OPPORTUNITIES' reveals how you can become technically qualified at home for a highly paid key-appointment in the vast Radio and Television Industry. In 176 pages of intensely interesting matter, it includes full details of our up-to-the-minute home study courses in all branches of **TELEVISION and RADIO, A.M. Brit. I.R.E., City & Guilds, Special Television, Servicing, Sound Film Projection, Short Wave, High Frequency, and General Wireless Courses.**

We definitely Guarantee

"NO PASS—NO FEE"

If you're earning less than £12 a week this enlightening book is for you. Write for your copy today. It will be sent **FREE** and without obligation.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
388b SHAKESPEARE HOUSE,
17-19 STRATFORD PLACE, LONDON, W1

BIET

MAGNETIC TAPE RECORDERS and COMPONENTS
from
WILL DAY, LIMITED
19 Lisle Street, London, W.C.2.
GERrard 7105 and 4476
LIST SENT BY RETURN

B. & H. RADIO
EAST STREET, DARLINGTON

BASS & TREBLE SEPARATOR
Divides output to Bass and Treble speakers. Permits adjustment of treble relative to bass and allows speakers of different impedances to be matched together. Kit of Parts £1 13 0

SCRATCH FILTER
Gives marked reduction of scratch level and cleans treble without serious attenuation 17 6

VARIABLE SELECTIVITY I.F. TRANSFORMERS. 465 K cs. Give 3 degrees of selectivity. Pr pair £1 1 0

WHISTLE FILTER
Is very simply inserted in the speaker wiring and gives a very sharp narrow cut which completely eliminates 9 K/cs whistle £1 15 0

SIGNAL GENERATOR
A complete portable signal source operating from a 4.5 volt battery £2 10 0

COILS: I.F. Transformers, Oscillator Coils etc. Rewound and returned C.O.D. Also Coils made to specification for Radio or Audio Frequencies. All Goods Guaranteed satisfactory or money refunded.

SITUATIONS VACANT

RADIO Production.—Manager required to operate small factory in south of Ireland; must have initiative and be able to modify basic designs; state experience and salary expected.—Box 0644. [6755

COMMUNICATIONS receivers; vacancies for skilled engineers having previous experience in this field.—" Q-Max " (Electronics), Ltd., 95, Villiers Rd., N.W.2 (Nr. Willesden Bus Garage). [6747

CAPABLE man of high intelligence and integrity as personal assistant to owner-manager of soundly established London retail radio business; state age and full details of career.—Box 0706. [6766

ELECTRONIC engineer required for research and development department; general electrical engineering experience essential; good prospects.—Bryans Aeroquipment, Ltd., Willow Lane, Mitcham Junction, Surrey. [6779

VACANCY exists for radio engineer holding current overhaul licence for maintenance and overhaul of aircraft radio and radar installations, should be experienced on A.S.V., T.R. 1143, T.1155 and T.R.1464 equipment. APPLICATION to be made in writing to—Technical Manager, Aquila Airways, Ltd., Hamble, Nr. Southampton. [6738

THERMIONIC technical assistant; must be keen on industrial electronics; some experience of audio equipment.—Please state age, experience and salary required, to The Rover Co., Ltd., Lode Lane, Solihull, Birmingham.

THE RESEARCH DIVISION of THE FAIREY AVIATION Co., Ltd., offer the following excellent opportunities to young men who are studying or intending to study for their Higher National Certificate (electrical or mechanical):
(a) JUNIOR Test Engineers required for development work on servo mechanism installation and associated equipment; experience of wiring automatic and remote control circuits essential.
(b) ASSISTANTS required for installation or testing of pneumatic and electrical servo controls; experience of instrument assembly desirable. Training will be given in this type of work and promotion would follow the award of the Higher National Certificate.
JUNIOR Staff Vacancies exist for men with experience of assembly and testing of electrical and gyroscopic instruments in automatic control systems; previous experience of similar work essential.
GRADUATE Engineers with experience in design of servo mechanisms and control systems required for research and development work in connection with automatic control of experimental aircraft; some electronics experience is desirable.
DEVELOPMENT and Test Engineers required for work on servo mechanism installations and associated control equipment. Minimum qualifications Higher National Certificate (electrical or mechanical); design experience on the above an advantage and some knowledge of electronics desirable.
ALL the foregoing vacancies are at Heston, nr. Hounslow, Middx. Pension Scheme. Apply in writing, giving full details of experience and qualifications to—Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middx, quoting reference RD/E2. [6448

LARGE company require radio testers and fault finders for all types of radio equipment; applications from men with domestic radio, television or V.H.F. experience should be addressed to the Personnel Manager, Box 0642. [6746

ELECTRONIC mechanic required by oil refinery for maintenance work on process controllers; applicants must have experience of automatic electronic control; industrial experience preferable but not essential.—Apply Box 0633. [6727

PLANNING/Project engineer required by an engineering firm in Buckinghamshire, minimum qualifications to include degree or higher national certificate and considerable practical experience of radio and centimetric radar.
PLANNING engineer also required with experience in manufacture and overhaul of radio and electrical equipment.—Apply in both instances, giving details applicable of previous experience, salary required and earliest date available to Box 0650. [6575

CORRESPONDENCE and records clerk required for service dept.; must have experience in dealing with customers' enquiries preferably with radio manufacturer.—Write, giving full particulars and salary required, Regentone Products, Ltd., Romford, Essex. [6795

ASSISTANT to Service Manager; must be capable of handling correspondence, staff and general records to maintain efficient operation of Service Department.—Write giving full particulars of experience and salary required to Regentone Products, Ltd., Romford, Essex.

PHYSICIST or physical chemist required for development work on a new type of resistor for communication purposes; a good degree or some industrial experience is essential; salary according to qualifications.—Painton & Co., Ltd., Bembridge Drive, Kingsthorpe, Northampton. [6799

RADIO and radar mechanics and electrical overhaul mechanics urgently required for interesting work of national importance; rate of pay up to 3/- per hour plus premium bonus.—Apply in writing or in person to Personnel Superintendent, Airtech, Ltd., Aylesbury & Thame Airport, Haddenham, Bucks. [6574

SENIOR development engineer required in the test gear department of large radio manufacturer; applicants must have technical knowledge of a high order and should have experience of development work in connection with electronic circuits.—Kindly state full details, including salary required, to Box 0645. [6756

More Good Investments

TRANSFORMERS: Double wound brand new, 110-230 V. 4.75 kVA., £17/10/-. B.T.H. 230 V. input 30 V. 6 A and 2 V. 20 A. output, 45/-. Foster 230 V. input, 50 V. 2 A. output, 15/-, carriage 2/-: 230 V. 50 c/s. input, 10 V. 80 A. 50 c/s. output, £12/10/-.
NEW DOUBLE WOUND 10-0-200/240v. 50 cy. Primary 3·4 k.v.-0-3.4 K.V. 1½ amps. sealed in metal case.
AUTO TRANSFORMERS: 230 volts, 50 cy., input 110 volts 75 watts, 25/-. 100 watts, 30/-. 150 watts, 35/-. 200 watts, 40/-. 300 watts, 60/-. 1KW., £7/10/-.
INDICATOR UNITS, Type 6: New and in transit case, with V.C.R.97 cathode ray tube, EF50 and EB34 valves, hood, dipole, etc. An interesting parcel of components for the amateur. 75/-, carriage 7/6.
MICROPHONES: Table type in adjustable frame, sound power model needing no battery, brand new, on solid base, with on/off switch, 8/6, post 1/6.
MORSE PRACTICE OUTFIT comprising precision made A.M. Morse Key with insulated bar and knob, twin coil buzzer with contacts, battery holder on base with diagram and instructions: 6/6, post 1/6.
MORSE KEYS: A.M. type on bakelite base, precision made with insulated knob 3/6, post 9d. Practice buzzer in metal case, 2/-. G.P.O. twin coil buzzer, 2/6, post 6d. Tiny Townsend high note wavemeter type buzzer, 5/-.
THE RAYCRAFT KIT: New, comprising 10,000 ohm relay, light ray cell in bakelite case, megastat, valve holder, condenser, etc., with instruction booklet, 45/-.
RECTIFIER UNITS: Ex-G.P.O. 230 V. A.C. 50 c/s. input. D.C. outputs 50 V. 5 A., 50 V. 1½ A., 50 V. ½ A., 30 V. 8 A., 30 V. 10 A., 12 V. 3 A., all in vent. metal cases, new condition; write for special list, "R.U.W."
Battery Chargers, Switchboards, Dynamos, Motors, Alternators, Lighting Plants, Motor Pumps, Rotary Converters in stock. Send us your enquiries.

ELECTRADIX RADIOS
214 Queenstown Road, London, S.W.8
Telephone: MACaulay 2159

FEEDBACK AMPLIFIER TEST figures as required.
Correct adjustment for complete stability and minimal ringing on reactive load—essential for optimum performance of home-made instruments. A valuable and inexpensive Laboratory Service.
DUN ELECTRONICS,
Riley Works, Riley Street, Chelsea, S.W.10.
Telephone: FLA 3217.

SPENCER WEST

The type AC/3 Pre-Amplifier is guaranteed to improve reception in Fringe areas when used in conjunction with any type of Television receiver. A very large number of unsolicited appreciations have been received and we respectfully suggest that it is in your interest to give one of these units a trial. Price 10 gns., complete to suit balanced or unbalanced feeders. Available in most districts from your Dealer or if in difficulty direct from us.

The type AC/4 Converter unit permits a London type receiver to be used for reception of Birmingham without alterations of any kind. Types AC/4A and AC/4B are also available ex-stock. These permit Birmingham type receivers to be used for London and Birmingham type receivers to be used for Holme Moss respectively. Price 15 gns. complete.

Leaflets are available for the above and other interesting Television units on application.

SPENCER WEST
Quay Works, Gt. Yarmouth

TYPE 36 MONITOR. Ideal unit for conversion into C.R.O. Contains 230 v. A.C. power pack, VCR139 cube with mu-metal screen and 9 useful valves **£6.**

AUTO TRANSFORMER. 500 V.A. 220 v. 110 v. **£2/10/-.**

SIGNAL GENERATOR. Type 22. 200mcs. Easily converted to 144 mcs. or T.V. band. Complete with 6 v. Vibrator pack in black metal case. **J.B.s Bargain of the month £1.**

METAL RECTIFIERS. 12 v. 1 amp. **10/6.**

ROTARY TRANSFORMER. Easily converted into A.C. Mains Motor **12/6.**

CHOKES. 20Hy 80Ma **6/6** ; 3Hy 200Ma **5/-** ; 20Hy 10Ma **3/-.**

AERIAL SWITCHING UNIT. Contains useful gears and small 12 v. motor **8/6.**

METERS. 50-0-50 amps. charge/discharge 2½in. square **8/6** ; 500 MicroAmp 2in. **7/6.**

HOT WIRE AMMETERS. 4½in. 0-10 amps. **7/6.**

HAND MICROPHONES. M.C. with switch **5/6.**

TRANSFORMER to match **3/6.**

XTAL DIODE DETECTORS. Cartridge Type **2/6.**

RESISTORS. Vitreous 717 ohms., tap 100 ohms., ·2 amp. Useful Mains dropper **2/6.**

ADMIRALTY S.M. DIAL. With white ivorine dial. Ratio 100-1. Finger tip control **5/6.**

INSULATORS. 3 Link Bakelite for Aerials, etc., **1/6.**

Prices quoted include postage, carriage.

THE "J.B." SERVICE
5, MAYPLACE ROAD WEST,
BEXLEYHEATH KENT

WANTED

End equipment, tubes and component parts.

Will pay highest prices.

END EQUIPMENT

APN-9	HS-23
ARC-1	T-17D
APN-4	American made ARC-3
SCR-522	R-5A/ARN-7
BC-640	BC-453
ART-13	SCR-720
BC-639	APR-4
BC-221	AT-4/ARN-1 Antenna
RTA-1B	TN-16, 17, 18, 19 and 54
HS-33	

TEST EQUIPMENT

TS-13	TS-174
TS-34	TS-182
TS-35	TS-203
TS-45	TS-235
TS-70	TS-251
TS-89	TS-270
TS-118	TS-263
TS-120	TS-268
TS-142	IE-19

ARROW SALES, INC.
1712 S. MICHIGAN AVENUE,
CHICAGO 16, ILL., U.S.A.
Phone : WEbster 9-7454

SITUATIONS VACANT

SERVICE engineer, radio and television; competent man, wide experience domestic receivers, must be able to drive; N.W. London.—Full details to Box 0637. [6735

THE G.E.C. is reorganising and expanding its radio engineering development and production units both for its peacetime needs and for Government contract work; it requires additional men of calibre and experience in its Coventry group of factories for work of considerable importance.
SUITABLE engineers, physicists, designers, draughtsmen, testers and production engineers with experience of electronics, telecommunications and radio are offered an unusual opportunity of joining this developing side of the company's business; good conditions, excellent social facilities, interesting work, pension scheme; considerable scope exists for men with energy and determination to overcome day to day difficulties.
WRITE, giving precis of training, experience, etc., and salary required. Interview either Coventry or London to The General Electric Co., Ltd., Radio and Television Works, Spon St., Coventry. [6587

DRAUGHTSMEN required, preferably with light electro-mechanical, electronic, or instrument experience for work of great national importance; applications from ex employees welcomed.—Write in first instance, quoting Ref. CHC/107, and giving full details, to Personnel Officer, General Electric Co., Ltd., Spon St., Coventry. [6740

DRAUGHTSMEN (electrical) with experience of schematic or detail wiring diagrams, are invited to apply for progressive positions in the drawing offices of the English Electric Co., Ltd., Liverpool.—Write giving full particulars, quoting ref. 140A, to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [6620

RADIO designer-draughtsmen for work in the field of radio communications including airborne and V.H.F. equipment are required by the G.E.C. Research Laboratories, North Wembley, Middx; at least 3 years' experience in a drawing office is essential.—Apply by letter to the Personnel Officer (Ref. GBLC/184), giving age, record and qualifications. [6758

E. K. COLE, Ltd., have vacancies in their Electronic Division at Malmesbury, Wilts. for senior and intermediate draughtsmen in the development drawing office, for work on radar, communications, and electronic projects; previous experience in this field desirable, but not essential.—Apply in writing to the Personnel Manager, Ekco Works, Malmesbury, Wilts. [6695

YOUNG electronics engineer required by a research laboratory of a large engineering firm in the Midlands to work on specialised strain gauge testing equipment; applicants should be 21 or 22 years of age, and should have had very sound training in radio or electronic engineering, together with some experience of practical development work.—Box 0711.

SENIOR Design Engineer required to undertake original work on electronic test equipment and iron cored components; qualifications required include degree or equivalent and the ability to initiate and develop new projects to the production stage.—Apply in writing, giving full details of experience, to Advance Components, Ltd., Back Rd., Shernhall St., E.17.

ATTRACTIVE and interesting opportunities are available in an independent research group located in West London on important radar projects; applications are invited from experienced Physicists or Electronic Engineers.—Give full particulars of age, education, qualifications, experience and salary required, to Box A.E. 254, Central News, Ltd., 17, Moorgate, E.C.2. [6623

RADAR and electrical control equipment technicians wanted for work of national importance; vacancies exist in various locations in the London and Home Counties area; good prospects exist of advancement; salary scale £400 p.a. rising to £525 p.a.; apply with full details of qualification, experience and area preferred, —1 A.A. Group Wksps. Shrapnel Bks., Woolwich, S.E.18. [6722

ELECTRONICS Section of the Motor Industry Research Association requires, for construction and development of electronic instruments, Laboratory Assistant of Ordinary National standard; age about 25; salary according to age and experience.—Reply, giving age, experience, qualifications, and salary required, to Motor Industry Research Association, Great West Rd., Brentford, Middlesex. [6706

RADAR and electrical control equipment technicians wanted for work of National importance; vacancies exist in various locations in the London and Home Counties area; good prospects exist of advancement; salary scale £400 p.a., rising to £525 p.a.—Apply, with full details of qualification, experience and area preferred, to 1 A.A. Group Wkshps., Shrapnel Bks., Woolwich, S.E.18. [6777

THE General Electric Co., Ltd., have vacancies for technical laboratory assistants at the Research Laboratories, North Wembley, Middx; candidates should have qualifications to about higher schools certificate or equivalent standard and preferably some experience in a laboratory or workshop.—Applications in writing should be sent to the Personnel Officer (Ref. GBLC/103), giving age and record. [6741

ATTRACTIVE staff vacancies for draughtsmen exist at Chelmsford and in West London with Marconi's Wireless Telegraph Co., Ltd., for electrical or mechanical draughtsmen; applicants for these permanent positions on the design and development of radio and radar equipment, should write giving full details quoting ref. 142C to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1.

NEW PRODUCTS

CHANCERY ADAPTOR. Place it on any 78 r.p.m. turntable (single record or autochange, rim or centre drive) and it gives you 33 r.p.m.—no fuss, no alterations **£3/12/6** ; Decca lightweight pickup fitted Acos GP20 permanent sapphire for L.P to match above, height and tone compensated **£2/13/-.** Both fittable by layman. **£6/3/-** the two, ins. post 2/6. Ex stock.

DECCA dual-speed motor and substantial turntable for 78 and 33 r.p.m. **£5/19/10,** ins. post 2/6.

LIGHTWEIGHT PICKUP to match, complete with Acos GP19 (78) and GP19LP (33⅓) plug-in cartridges with permanent sapphires **£5,** post 1/- ex-stock.

N.R.S. DUAL-SPEED RECORD PLAYER, comprising above Decca motor and lightweight pick-up with two Acos plug-in cartridges (GP19 and GP19LP) in portable leatherette case. Sensational value at **£13/13/-** (carriage 5/-) ex-stock.

DECCA LONG-PLAYING RECORDS by Post. Send 2½d. for list of titles.

SYMPHONY NO. 1 (AMPLIFIER) by N.R.S. The most versatile domestic Audio Amplifier on the market today ! Independent control of Bass, Middle and Top, separate Scratch Cut, negative feedback. For A.C. 200-250 v., input for magnetic, crystal and hi-fi pickups also Tuner. 5-watt output. Price 3 ohm model **£9/9/-** ; 15 ohm model **£9/17/-.** Carriage 5/-.

SYMPHONY NO. 2. Same theme as No. 1 but having 10 watts Push-Pull output : 3, 7.5 and 15 ohms. Inputs as No. 1—full provision for Tuner. Woden Mains Transformer. Output trans. and Choke. Price **£13/19/6.** Carriage 5/-.

NO. 2 PUBLIC ADDRESS AMPLIFIER, as No. 2 Symphony but with ordinary tone control only. Has two inputs—one for gram. and one for mike—with separate volume controls for fading in and out. Complete kit with instructions **£9/10/-,** or built **£10/19/6.** Crackle cover etc., **£2** if required.

NO. 1 TUNER. Specially recommended for above amplifiers and Leak, Williamson and other Quality Amplifiers. L. & M. wave T.R.F., neg. feedback detector—virtually distortionless. Price of Complete Kit and Constructional Manual **£4/15/-** or Ready-built **£5/15/-.** Post 2/6.

NO. 2 QUALITY SUPERHET TUNER. L.M. & S. waves, special bandwidth, large full-vision Dial Assembly, spin-wheel tuning. As kit **£8** ; Ready-built **£9.** Carriage 5/-.

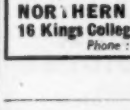
BASS-REFLEX CABINET KITS give superb bass response and top. (¾in. patent timber) full instructions supplied. 8in. speaker model 2ft. 6in. high x 1ft. 3in. x 1ft. deep. Price **80/-** ; 10in. speaker model **90/-** ; 12in. speaker model **100/-.** Any of above ready built for **7/6** extra. Carriage in any case 7/6.

RECOMMENDED HI-FI SPEAKERS. Full Wharfedale range in stock.

Send 2½d. now for new CATALOGUE AND BARGAIN SUPPLEMENT, indispensable to all Quality Enthusiasts. TERMS c.w.o. or c.o.d. Callers welcome. Demonstrations Monday to Saturday (inclusive) 9 a.m. to 6 p.m.

NORTHERN RADIO SERVICES,
16 Kings College Road, London, N.W.3
Phone : PRImrose 8314.

THIS → *Does these*



ACCURATELY and QUICKLY Chassis Brackets, Shrouds, Condensers and Transformer Clips, in Steel or Aluminium (Five sizes—12" to 26") Trepanner available **"SNAP" Cutter, Notcher and Shearer.**

Details with pleasure.

A. A. BENDERS are proving invaluable to Electronics, Electro-Medical, Radio and other Research Workers.

A. A. BENDERS are used by :—
Admiralty (six orders)
Anglo Iranian Oil Co., Ltd.—Research.
Please ask for copy of NEW 6-page Folder; it is FREE !

A. A. TOOLS (W), 197a, Whiteacre Road **ASHTON-U-LYNE**

POTENTIOMETERS

Wire-wound and Composition types. Single, Ganged, Tandem Units. Characteristics: linear, log., semi-log., non-inductive, etc. Full details on request.

RELIANCE

RELIANCE MNFG. CO. (SOUTHWARK), LTD.
SUTHERLAND ROAD, HIGHAM HILL, WALTHAMSTOW, E.17.
Telephone: Larkwood 3245

TELECRAFT

AERIALS ENSURE THE **BEST TELEVISION**

TRY ONE AND SEE FOR YOURSELF

NOW AVAILABLE

GERMANIUM CRYSTAL DIODES

LATEST, SMALLEST, SUPREME CRYSTAL DETECTOR.
Midget Size, 5/16in. x 3/16in.
Wire Ends for Easy Fixing.
4/6 each, postage 2½d.

Technical Details and Selected Types available.

SILICON DIODES, 3/6. Postage 2½d.
Fixing Brackets, 3d. pair.

COPPER INSTRUMENT WIRE
ENAMELLED, TINNED, LITZ.
COTTON AND SILK COVERED.
Most gauges available.
B.A. SCREWS, NUTS, WASHERS, soldering tags, eyelets and rivets.
EBONITE AND BAKELITE PANELS, TUFNOL ROD, PAXOLIN TYPE COIL FORMERS AND TUBES, ALL DIAMETERS.
Latest Radio Publications.
SEND STAMP FOR LISTS.
TRADE SUPPLIED.

POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

SITUATIONS VACANT

A NUMBER of senior and junior vacancies for radio, radar, electronic, television, etc., development, service engineers, draughtsmen, wiremen, testers, inspectors, etc., urgently required 50 television service engineers.—Write in confidence, Technical Employment Agency, 179, Clapham Rd., S.W.9. (Brixton 4567.) [0046

BRITISH OVERSEAS AIRWAYS CORPORATION have vacancies for radio mechanics experienced in radio maintenance and/or overhaul; rates of pay 2/10 per hour plus 4½d. per hour provisional bonus; attracting proficiency pay up to 3d per hour; five-day, forty-four hour week, possible shift work; good pension, sick pay and holiday facilities.—Write or call Staff Manager, Hut 29, London Airport. [6704

DIGITAL COMPUTERS: Ferranti, Ltd., Moston, Manchester, are engaged upon the long-term development and exploitation of digital computers; this interesting work covers vacuum physics, the electronic and electrical properties of materials, computing and pulse circuit techniques, electrical and mechanical recording, electro - mechanical mechanisms, precision mechanical engineering and power supply equipment.
IN the course of this work there are occasional vacancies for senior engineers with wide experience from whom enquiries will be welcomed at any time.
THERE are immediate vacancies for:—
(1) ENGINEERS and scientists for research and development work in the above fields; qualifications include a good Honours Degree in Physics or Engineering or equivalent experience; salary according to qualifications and experience in the range £450 to £1,000 per annum; please quote Ref. D.C.E.
(2) TECHNICAL ASSISTANTS for experimental work in the above fields; qualifications are a Degree or Higher National Certificate in Engineering or equivalent; salary according to age and experience in the range £320 to £650 per annum; please quote Ref. D.C.A.
THE company has a staff pension scheme and will give housing assistance in special cases.—Application forms from the Staff Manager, Ferranti, Ltd., Hollinwood, Lancs. [6718

RADIO/TELEVISION Service Engineers required the Greater Birmingham area; substantial incomes assured to first-class men; clean driving licence essential and own car an advantage.—Apply Midlands Manager, Sobell Industries, Ltd., 36, Dalton St., Birmingham. Telephone Central 8039. Similar vacancies exist in Lancashire, Yorkshire and Scotland.—For details apply Service Manager, Langley Park, Slough, Bucks. [6709

FIRST-CLASS opportunities for graduate engineers and physicists with good honours degrees are available at the Research Laboratories of The General Electric Co., Ltd., North Wembley, Middx; all vacancies will be for experimental or design work mainly in the fields of electronic and mechanical engineering; a limited number will be concerned primarily with vacuum physics; openings will occur in three grades as follows:—
(a) SECTION Leaders.—first-class experience is essential; only men aged 27 or over, with proved ability to lead research teams will be considered.
(b) POST Graduate Research physicists and engineers who are completing their theses for advanced degrees this summer and who are seeking interesting experimental work in an industrial research laboratory.
(c) UNIVERSITY students who will be sitting for finals in physics or engineering during the next three months.
STARTING salaries will be dependent on academic qualifications, age and experience and prospects of advancement will be exceptionally good; further particulars will be sent to all applicants who forward details of their record to the Personnel Officer (Ref. GBLC/103); interviews will be arranged during the next few weeks for graduates available between April and the end of September. [6742

DESIGN engineer required by unit of English Electric Co., Ltd., working on important defence project to undertake detailed design and layout of electromechanical analogue computing devices, degree or H.N.C. essential and experience of anti-aircraft predictors, Magslip applications or the like desirable.—Write giving full details and quoting ref. 862, to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [6663

MANAGER required for television service depot in Manchester; applicant should have minimum qualifications, Higher National or City and Guilds Final; he should be capable of administering small service and distribution depot; able to cope with technical problems concerning TV; capable correspondent and able to control labour; applicant will be required to live in the Manchester area; excellent salary to right man; write full particulars to Box 0631. [6717

INTERNATIONAL AERADIO, Ltd., have vacancy for radio technician, preferably single, in Khartoum; M.C.A., A.R.M.E. licence desirable; experience installation and maintenance Dove equipment; Marconi AD 107/108; ST and C STR8s and 953 Beacon; commencing salary single man £710-£790, quarters provided; no income tax; free passages; pension fund; medical facilities.—Write, Ref. RMK, Personnel Officer, 40, Park St., W.1. [6745

LABORATORY Assistant (female); at least 4 Matriculation standard, including electricity and magnetism; to work on quality control of radio receiving valves; hours 7.30 a.m. to 5.15 p.m., 5-day week; age 20 to 30 years; salary according to age and experience; chances of finding local accommodation remote.—Apply in writing to Miss M. B. Little, Women's Personnel Officer, Mullard Radio Valve Co., Ltd., New Rd., Mitcham Junction, Surrey. [6700

NORTHERN TRANSFORMERS CO.

TRANSFORMER HOUSE,
215, BARKEREND RD., BRADFORD, YORKS.

All Transformers guaranteed against faulty workmanship

ALL PRIMARIES ARE TAPPED 200/250 v. INPUT

MAINS TRANSFORMERS

DT/150, 350-0-350 v. 150 m/a., 6.3 v. 4 a. C.T., 5 v. 3 a.	35/6
MF/150, 350-0-350 v. 150 m/a., 6.3 v. 4 a. C.T., 5 v. 3 a.	37/9
DT/100, 350-0-350 v. 100 m/a., 0-4-6.3 v. 3 a., 0-4-5 v. 3 a.	25/6
MF/100, 350-0-350 v. 100 m/a., 0-4-6.3 v. 3 a., 0-4-5 v. 3 a.	27/9
DT/80, 330-0-330 v. 80 m/a., 0-4-6.3 v. 3 a., 0-4-5 v. 3 a.	24/3
MF/80, 330-0-330 v. 80 m/a., 0-4-6.3 v. 3 a., 0-4-5 v. 3 a.	26/6
DT/M3, 350-0-350 v. 80 m/a., 6.3 v. 3 a., 5 v. 2 a.	22/6
MF/350, 350-0-350 v. 250 m/a., 6.3 v. 6 a., 4 v. 2 a., 0-2-6.3 v. 2 a., 4 v. 5 a.	68/6
MF/160, 350-0-350 v. 160 m/a., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a.	44/6
MF/120, 350-0-350 v. 120 m/a., 6.3 v. 4 a., 5 v. 3 a.	34/6
DT/120, 350-0-350 v. 120 m/a., 6.3 v. 4 a., 5 v. 3 a.	33/9
DT/M2, 250-0-250 v. 80 m/a., 6.3 v. 3 a., 5 v. 2 a.	20/6
DT/80, 250-0-250 v. 80 m/a., 6.3 v. 3 a., 5 v. 2 a.	21/6
MF/M2, 250-0-250 v. 80 m/a., 6.3 v. 3 a., 5 v. 2 a.	22/9
Williamson O.P. Transformer	37/6
Williamson Mains Transformer, 425-0-425, 6.3 v. 4 a. C.T., 5 v. 3 a., 6.3 v. 4 a. C.T.	53/6
Williamson Choke, 30 H., 20 m/a., shrouded	22/3
Williamson Choke, 50 H. 50 m/a., shrouded	24/9
Williamson Choke, 10 H., 150 m/a., shrouded	33/6
Williamson Pre-Amplifier Transformer	23/9

WE HAVE A SPECIALS DEPARTMENT WHICH DEALS SOLELY WITH WINDINGS TO ANY SPECIFICATION

DT = Drop Through type. MF = Fully shrouded type. DT/M = Smaller Drop-through type. MF/M = Smaller fully shrouded type.

RELAYS P.O. TYPE 3000. SIEMENS HIGH SPEED.
CONTACTS up to 6 changeover. COILS up to 20,000 ohms. Large stocks held. Also: TELEPHONE HANDSETS, JACK SOCKETS, KEY SWITCHES, SLYDLOK FUSES, CONDENSERS, Etc. *Wholesale Only.*
L. WILKINSON
19, LANSDOWNE RD., CROYDON, SURREY

Prominent Aircraft Firm

in Greater London area commencing New Project of great National importance offers unique opportunity for advancement.

High salaries with monthly staff status and pension scheme offered to suitably qualified applicants.
Electronic Engineers with 1st class honours degree or equivalent qualification.

Apply stating age, nationality and experience to Box AC.59820 Samson Clark & Co. Ltd., 57/61 Mortimer Street, W.1

AN IMPORTANT ANNOUNCEMENT!

to all interested in passing their G.P.O. MORSE CODE TEST for an Amateur Transmitting Licence.

We have been pleased to arrange a Special Candler course (at a fee within the reach of all) which includes all the training essential to enable you to be successful.
Full details will be sent to all who apply for the CANDLER "BOOK OF FACTS".

Read the following extracts from unsolicited testimonials sent us by Candler students.

Ref. 7376 : "I am very pleased with this method of training and I passed the G.P.O. Morse test after third lesson. Since getting my call sign I have been complimented very often on my 'good fist.'" **W.E.**

Ref. 5173 : "So far, after only completing half the course, I am pleased to say that my speed in both sending and receiving has risen from a mere 5 w.p.m. to a steady and 100 per cent correct 15 w.p.m. This has enabled me to obtain my Amateur's Licence here within a very short time of commencing my study of the code." **L.R.**

Ref. 7161 : "I may add that I passed my G.P.O. Morse test for the Amateur Transmitting Licence a week or so ago and am very pleased that the first five lessons enabled me to do so. It was not as difficult as I had imagined." **J.R.D.**

Ref. 3301 : "I have successfully passed the P.M.G. Amateur's Licence test and have been allotted my call sign. I took it with ease, after completing lesson three." **V.H.T.**

IMPORTANT. Mention "Special Course" when you apply for a copy of the "BOOK OF FACTS".

THE CANDLER SYSTEM CO., (55W) 121 KINGSWAY, LONDON, W.C.2
Candler System Company, Denver, Colorado, U.S.A.

If you care to call at

MODERN ELECTRICS LTD.,

164, CHARING CROSS ROAD, W.C.2
TEMple Bar 7587

we should be pleased to demonstrate and give immediate delivery of the

"SOUND MIRROR"

TAPE RECORDER

as described and illustrated on Page 32

"NOT the cheapest but certainly the BEST"

S.A.E. please for catalogue
Export enquiries welcomed

SITUATIONS VACANT

STRUCTURAL designer required by Marconi's Wireless Telegraph Co., Ltd., Chelmsford; must have experience of guyed radio masts, towers or similar structures; a general mechanical engineering background would be an advantage; senior designer draughtsman with suitable qualifications would be considered.—Please write, giving full details and quoting ref. 854A, to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [6704

ASSISTANT required by large firm in Aden to handle electrical, automotive and radio (including marine) business; some practical experience of the wholesale or retail trade in electrical and radio appliances desirable; radar and/or refrigeration experience helpful but not essential; board, quarters and free passages to and from Aden provided; salary about £400 p.a., according to qualifications and experience. —Apply, giving full particulars, to Box 0709.

BELLING & LEE, Ltd., 540, Cambridge Arterial Rd., Enfield, Middlesex, wish to engage a specialist to conduct aerial research and development, particularly at television frequencies; applicants must possess scientific qualifications, together with considerable experience in the field, must be imaginative and original, and able to work with minimum supervision; excellent research facilities are available, and an attractive salary will be offered to the right applicant. [6704

ACCOMMODATION available for applicants selected to fill further vacancies arising for capable design engineers and senior draughtsmen, having extensive electronic, electro-mechanical or instrument experience; successful candidates will be employed on work of great national importance; attractive terms and working conditions in first instance, quoting Ref. CHC/106 and giving full details, to Personnel Officer, General Electric Co., Ltd., Spon St., Coventry. [6739

McMICHAEL RADIO, Ltd., require senior project engineers in their equipment division laboratory at Slough, training and experience in the field of applied electronics (including communications) and experience of working with Government Departments are the chief qualifications required; salary will be commensurate with ability.—Write, stating age and full details of training, qualifications and experience, to the Chief Engineer, Equipment Division, McMichael Radio, Ltd., Slough, Bucks. [6671

A SALES Office Administrative Assistant is required for the Electronic Control Equipment Department of a large Midlands firm; applicants should be experienced in dealing with representatives and with customers' enquiries, and have some knowledge of organized sales promotion and selective circularisation; preference will be given to those who have light current technical training or practical background. —Write, giving details of experience and mentioning ref. HBG, to Box 0630. [6716

ENGLISH ELECTRIC, Stafford, invite applications from young engineers who are interested in relay and meter design; previous experience desirable but not essential; qualifications, degree in electrical engineering with bias towards mathematical part; facilities exist for giving successful applicants a thorough education in the design and development of meters and relays.—Apply, giving full details and quoting Ref. 444B, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham Street, London, S.W.1. [6572

SEVERAL vacancies exist in the development laboratory of the General Electric Co., Ltd., Witton, for development engineers in the electronics, small motor engineering and high power switchgear test sections; applicants should preferably possess a degree or Higher National Certificate in electrical engineering, but those taking their final examination this year will also be considered; salaries will depend upon qualifications, age and experience.—Apply in writing, giving full particulars, to Staff Manager, General Electric Co., Ltd., Witton, Birmingham, 6. [6784

ENGLISH ELECTRIC have vacancies for senior design draughtsmen for employment in the Midland and West London areas on industrial electronic equipment draughtsmen, with good light/medium mechanical engineering experience, preferably with some knowledge of design for quantity production, are invited to apply. These are permanent vacancies offering much scope on new types of electro-mechanical equipment.—Write, giving full details, quoting ref. 156A, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., S.W.1. [6592

THE Research Laboratories of The General Electric Co., Ltd., East Lane, North Wembley, Middlesex, have a vacancy for an engineer for field trials on a development project; experience with electronic equipment and organizing ability are essential; an ex-service radar or signals officer would be suitable; this position will involve considerable periods spent away from the laboratories but continual travelling will not be involved. Applications in writing should be sent to the Personnel Officer (Ref. GBLC/997), and should give details of age, qualifications and experience. [6698

RESEARCH men required by Marconi's Wireless Telegraph Co., Ltd., Chelmsford, for work on problems connected with frequency measurements and stability up to micro-wave frequencies; vacancies exist both for highly qualified engineers or physicists with good experience in this field, as well as for a number of Juniors with H.N.C. or similar qualifications; salaries offered will be by arrangement and will depend upon the qualifications and experience of the applicant; pension scheme.—Please write, giving full particulars and quoting ref. 865, to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [6710

NUSOUND PRODUCTS

136 WARDOUR STREET, LONDON, W.1

(Oxford Street end)

Tel : GERrard 8845

NUSOUND QUALITY AMPLIFIERS.
3) WATT OUTPUT. PP 6V6s—independent bass and treble boost and cut—switch for L.P. records—neg. feedback—provision for radio feeder unit—freq. response 25 to 20,000 c.p.s. ± 1 d.b.—hum 80 d.b. down at 0.5 watts—feedback 14 d.b.—sensitivity .65 volt. Price only **£14 14 -.** Also available with remote control unit. Price **£16 16 0.**

4) WATT OUTPUT—independent bass and treble boost—preamp.—provision radio feeder unit, **£10 10 -.** Constructional booklet, **1 8**, post free. Complete kit, **£8.**

NUSOUND QUALITY FEEDERS.
Pre-set TRF—Home, Light and Third with gram. position—air spaced trimmers for stability of tuning. Size 6in.-7in., height 4in., **£6 10 8**, inc. Constructional booklet, **1 8**, post free. Can be built for **£3 12 6.** Pre-set S/Het.—Home, Light and Third—choice of MW and LW Light—Gram. position. Size 6in.-7in., height 4½in., **£8 10 8** inc. (Please send S.A.E. for descriptive leaflet on all our products.)

VARIABLE RADIO TUNER UNIT—MW and LW Bands—S/Het. of small dimensions—R/Gram. switch etc. Our latest model. Price **£9 9 -** inc.

NUSOUND REMOTE CONTROL & PRE-AMP. UNIT. Bass boost—Treble boost and cut—V/C and switch—L.P. correction switch—Gives a gain of 10 : 1 in voltage —Ideal for Williamson and W.W. Amplifiers. Price **£4 10 -.**

REFLEX CABINET.
At last, a reflex cabinet for the famous Wharfedale 10in. Speakers. Sizes 30in., 18in., 17in. Complete with reflector—Bass port—Polished finish. A handsome piece of furniture. Price **£9 9 -.**
A 12in. Model is also available at **£10.**

GRAMOPHONE EQUIPMENT. Connoisseur Pups Standard L/weight, **£3 19 -**; Trans. **13 -**; Super L/weight, one head, **£5 14 8**; Micro-groove head, **£5 11 8**; Trans. **15 -**; Fibre P/up, **£4 3 -**; Special Trans. **25 -**; Garrard plug-in heads, standard, **25 -**; Miniature, **40 7**; Hi Fi, **53 6**; Adaptor **6 6**. Collaro AC47 78 r.p.m. centre drive, **£5 18 2**; Collaro A.C./D.C. motors, 12in. turntable, **£9 3 6**. Chauncery L.P. Attachment G.33, **£3 12 6**, with Decca L.P. Xtal P/up **£6 2 3.**

Decca three-speed motor, **£7 3 6**; Connoisseur two-speed motor **£20 19 3**; Decca Xtal P/up **53 -**; second Acos insert for L.P., **31 6**—(similar to GP20. Decca Turnover Xtal P/up, L.P. or 78, **£3 19 4.** We keep a full range of Wharfedale Speakers in stock.

NUSOUND TRANSFORMERS AND CHOKES.
A selection from our range and we can wind to your spec., delivery approx. 7 days. Estimates free.
350-0-350 v. 150 m/a., 6.3 v. 4 a., 5 v. 3 a., **40 -.**
350-0-350 v. 100 m/a., 6.3 v. 3 a., 5 v. 2 a., **31 -.**
300-0-300 v. 100 m/a., 6.3 v. 3 a., 5 v. 2 a., **29 6.**
6.3 v. 1½ a. Heater trans. 230 pri. only, **7 3.**
4 v. 2 a. Heater trans. 230 pri. only, **7 3.**
6 v. 6 a. C.T. Heater trans. 230 pri. only, **17 3.**
6.3 v. 3 a. C.T. Heater trans. 230 pri. only, **12 6.**
12 v. 1 a. C.T. Heater trans. 230 pri. only, **8 6.**
CH4, 10 H., 150 ohms, 75 m/a., **4 9.**
CH8, 10 H., 300 ohms, 60 m/a., **4 9.**

Please add Postage.

Our comprehensive list of TV—Radio and Gramophone equipment, etc., is now available. Price **4d.** post free.

CRYSTALS

TYPE "M"

Range 8 to 17 mc/s
Hermetically sealed metal can 0.75" high under pins, 0.75" wide, 0.375" thick, with ⅛" diameter pins at 0.490" centres.

BROOKES CRYSTALS LTD.

10, Stockwell St., Greenwich, London, S.E.10

Phone: GREenwich 1828. Cables: Xtals, London. Grams: Xtals Green, London

Prominent Aircraft Firm

in Greater London area commencing new project of National Importance offers unique opportunity for advancement.

High salaries with monthly status and pension scheme offered to suitably qualified applicants. Engineers required with good theoretical and practical experience in design and research in any of the following specialist groups:—

(a) RADAR, Marine or Aircraft, (b) U.H.F. Radio, (c) Low Frequency Amplifiers, (d) Electro-mechanical measurement techniques.

City and Guilds qualification or University degree desirable though not essential.

Apply, stating age, nationality and experience, to Box AC.60195, Samson Clark & Co. Ltd., 57/61, Mortimer Street, W.1.

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE

ROD, BAR, SHEET, TUBE, STRIP, WIRE.

3,000 STANDARD STOCK SIZES

No Quantity too Small. List on application.

London: H. ROLLET & Co. Ltd. Liverp'l:

6, Chesham Place, S.W.1. Kirkby Estate.

SLOane 3463. SIMONSWOOD 3271/3

QUARTZ CRYSTAL UNITS

QCC

For—

AIRCRAFT, MARINE AND COMMERCIAL USE are available in the complete range from 35 kilocycles to 15 megacycles.

Alternative mountings in standard two-pin A.M. pattern 10X, International octal, and miniature type FT243, can be supplied for most frequencies.

Prices are fully competitive, and we specialise in prompt deliveries for urgent requirements.

WE WELCOME YOUR ENQUIRIES.

THE QUARTZ CRYSTAL Co., Ltd

63-71 Kingston Road,

NEW MALDEN, SURREY

Telephone: MALden 0334

SITUATIONS VACANT

TELEVISION and Radio 1st Engineer required in supervisory capacity by E. London firm, with all leading agencies; salary (according to ability and initiative) in higher wage group.—Apply (references requd.) to "LB," Leytonia Radio, 926, High Rd., E.10. Ley. 1396. [6699

INTERNATIONAL AERADIO, Ltd., has vacancies at Bovingdon Airport, near Watford, for Radio Mechanics experienced installation and maintenance ground equipment for radio work of national importance; possibility overseas appointment later if desired; pension scheme; two weeks' paid annual leave; single accommodation may be available; canteen facilities.—Write, quoting reference RMH and this newspaper, Personnel Officer, 40, Park St., London, W.1. [6711

GOLD Coast, Nigeria.—British company established throughout West Africa require the services of a qualified radio engineer, some knowledge of refrigeration servicing an asset but applicants would receive preliminary training in this and other sections of the service departments before sailing; excellent opening for the right man covering selling and administrative side of business as well as actual servicing; good salary, prospects, first-class passage, free furnished quarters, pension scheme; applications should be in own hand writing, stating age (preferably between 21 and 26), whether married or single, full details education, qualifications, national service and business experience; original references should not be sent.—Apply Box 0634. [6729

ADMIRALTY.—Vacancies exist for electrical and/or mechanical engineering draughtsmen in Admiralty Research and Development Establishments located in the vicinity of Weymouth, Portsmouth, Teddington (Middlesex) and Baldock, Herts; draughtsmen experienced in light current, electro-mechanical, precision mechanical and electronic equipment are particularly needed; candidates must be British subjects of 21 years of age and upwards, who have had practical workshop experience (preferably an apprenticeship) together with drawing office experience; appointments will be in an unestablished capacity, but opportunities may occur for qualified staff to compete for established posts; the salaries offered, depending on age, experience, ability and place of duty, will be within the range £285—£510 p.a.; exceptionally well-qualified candidates may be considered for appointment in a higher grade within the salary range £470—£610 p.a.; hostel accommodation is available at some establishments.

APPLICATIONS, stating age and details of technical qualifications and apprenticeship (or equivalents) and workshop and drawing office experience, should be sent to Admiralty (C.E.II, Room 88), Empire Hotel, Bath; original testimonials should not be forwarded with application; candidates required for interview (at London or Bath whichever is nearer) will be advised within two weeks of receipt of application. [6621

SITUATIONS WANTED

YOUNG man seeks admin. post with prospects; wide exp. radio and T.V.; Central London.—Box 0706. [6771

FREE-lance engineer, p.a. sound, radio, television, covering Lancs, Cheshire, N. Wales; own car, equipment; available service.—Box 0628. [6713

GENERAL manager, 30 years' experience executive, commercial, light, medium and radio engineering, complete manufacture, desires change.—Box 0632. [6720

YOUNG man of culture and initiative with wide experience of electronics and light electrical engineering, accustomed to accepting responsibility, seeks new position.—Box 0636. [6734

FINANCIAL PARTNERSHIPS

DIRECTORSHIP available, well-established company, 50% shares, south coast, electrical contractors, radio, T/V; preference to practical applicant; capital required about £2,000; full details.—Box 0641. [6744

TECHNICAL TRAINING

E.M.I. gave the world electronic television; E.M.I. is now giving the finest home study television courses, moderate terms, facilities for easy payment.—Free brochure giving full details on application to the registrar, Dept. WW1, E.M.I. Institutes, 10, Pembridge Sq., London, W.1. Bayswater 5131/2. [0179

CITY & Guilds (Electrical, etc.), on "No Pass—No Fees" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 176-page handbook, free and post free.—B.I.E.T. (Dept. 389A), 17, Stratford Place, London, W.1.

PATENTS

THE proprietor of British Patent No. 567462, entitled "Electronic Tube" offers same for licence or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern & Carlberg, 14E, Jackson Boulevard, Chicago 4, Illinois, U.S.A. [6625

PAINTS, CELLULOSE, ETC

PAINT spraying handbook 3/6, post free; cellulose and synthetic paints and all spraying requisites supplied; catalogue free.—Leonard Brooks, 53, Harold Wood, Romford. [0207

TRADE MARKS

THE Trade Mark No. 540354 consisting of the word "Stanelectric" and registered in respect of wireless telephone instruments, telephonic and telegraphic instruments, and sound amplifiers for gramophones, was assigned on November 9th, 1950, by William John Hammond Lambert of "Brooklands," London Rd., Stanstead, Essex, to Standard Telephones and Cables, Ltd., 63, Aldwych, London, W.C.2, without the goodwill of the business in which it was then in use. [6757

Make a better job of it! with the

HENLEY SOLON TRADE ELECTRIC MARK **SOLDERING IRONS** 5 models

FOR INDUSTRIAL USE

ALL THE HEAT IS IN THE BIT

PERFECT BALANCE FOR EASY HANDLING

ALL CONNECTIONS HOUSED AT END OF HANDLE AWAY FROM THE HEAT

CORD GRIP SECURES FLEXIBLE (prevents twist or pull being transmitted to internal wiring)

Write for Folder Y. 10.

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.,

51-53 Hatton Garden, London, E.C.1

"Quixo" RADIO Cell Tester

Accurate tests High, Low and Grid Bias Batteries.

Write for leaflet 30M

Visit Stand G.730 B.I.F.

RUNBAKEN MANCHESTER

SAMSONS SURPLUS STORES

PRITCHETT & GOLD 6 v. 100-125 A.H. BATTERIES in teak cases, size 16in. x 11in. x 8in. Brand new. **£6/10/-.**

DELCO 6 v. CAR BATTERIES, size 9in. x 9in. x 7in. Brand new. **£4/15/-.** *Above batteries callers only.*

WILLARD 12 v. 85 A.H. BATTERIES in vulcanised case, size 13in. x 10½in. x 7½in. Brand new. **£6/10/-,** carriage 5/-.

E.D.C. ROTARY CONVERTERS. D.C. input 200-220 v., A.C. output 230 v. 185 watt, completely shrouded in metal case. **£10/10/-,** carriage 5/-.

HEAVY DUTY AUTO. TRANSFORMERS. 1.6 KVA tapped 0, 110, 150, 190, 230 volts. **£4/17/6,** carriage 5/-.

HEAVY DUTY FILAMENT TRANSFORMERS, sec. 6.3 v. 15 amp. Prim. 200/240 v. 50 cycle. **17/6,** carriage 1/6.

SPECIAL OFFER. A.M. 6 mfd. 1500 v. condensers, size 4½in. x 3½in. x 3in. **5/6,** carriage 9d.

30FT. LENGTH COILS CO-AXIAL CABLE, with Pye sockets on each end. **8/6,** carriage 1/-.

169/171 Edgware Road, London, W.2. Pad. 7851
125 Tottenham Court Rd., W.1. Mus. 4982

All orders and enquiries to our Edgware Road branch, please. Open all day Saturday at the Edgware Road Branch.

MAINS TRANSFORMERS

Interleaved and impregnated. Screened
Primaries tapped 200/250 volts.

Drop Through Type. Top shroud.

250-0-250 v. 60 m/a., 6.3 v. 3 a., 5 v. 2 a **18/6**

Following types have Universal L.T. windings : 6.3-4-0 v. 4 a. C.T., 5-4-0 v. 2 a

250-0-250 v. 80 m/a..... **22/6**
300-0-300 v. 60 m/a..... **22/6**
350-0-350 v. 80 m/a..... **22/6**
250-0-250 v. 100 m/a..... **25/-**
300-0-300 v. 100 m/a..... **25/-**
350-0-350 v. 100 m/a..... **25/-**

Fully Shrouded Upright Types.

350-0-350 v. 150 m/a., 6.3-4-0 v. 6 a. C.T., 5-4-0 v. 3 a..... **42/6**
350-0-350 v. 250 m/a., 6.3 v. 7 a., 4 v. 8a., 4 v. 3 a., 0-2-6.3 v., 2 a..... **59/6**
425-0-425 v. 180 m/a., 6.3 v. 4 a., C.T., 6.3 v. 4 a., C.T. 5 v. 3 a. (suitable for Williamson Amplifier)..... **52/6**

Williamson Amplifier Components.

Output Transformer 1.7 Ω secs..... **85/-**
Main Amp. Chokes No. 1..... **15/6**
No. 2..... **25/-**
Pre-amp Choke 50 H. 20 m/a. 1500Ω... **18/6**
Pre-amp. Mains Transformer, 325-0-325 v. 20 m/a., 6.3 v. 1.5 a., 6.3 v. 0.6 a.... **25/-**

Undrilled Aluminium Chassis.

16 S.W.G., 4 sides 3in. deep,
10in. x 6in., 10in. x 8in., **10/6** ; 12in. x 9in., **12/6**;
14in. x 9in., 16in. x 8in. **13/6** ; 14in. x 10in. **14/6**.

Tallon Viewmaster Cabinets.

9in. Table Model..... **£6 5 6**
12in. Table Model..... **£7 17 6**
9in. Console Model..... **£13 3 0**
W.B. 9in. Table Model..... **£7 17 6**

B.V.A. and TUNGSRAM VALVES.

Send for the Valves you require and pay the postman C.O.D.

Send 5d. stamps for lists.

COULPHONE RADIO
53, Burscough Street, Ormskirk, Lancs.

DUKE & CO.

MUST BE SOLD. SPACE REQUIRED.

TYPE 53 TRANSMITTER. 3/6. 2.4 to 6.5, 4.8 to 13 m/cs. Some slightly damaged and a little dirty, contains:—44 conds ; (including 5 tuning); 17 res.; midget V/control for speaker; 3 V/holders (less valves); choke; dial working on continuous 3 scroll (slow motion); lamp holder, toggle type switch; 2 coaxial sockets, w/change switch, 3 P.B. worm drives, chassis sockets (folding handle) springs, 5 coil formers, metal chassis in aluminium case, 9½ x 6½ x 6½in., sets not guaranteed complete. Post 1/6.

TYPE 32/40 TRANSMITTER. 2/6. Relay, crystal and coil wire removed. Otherwise perfect. Transmitter includes:—11 res.; 11 fixed cond.; 6-way Jones socket; 3 international V/holders; 2 tag panels; press button switch, panel of sockets for crystals; s/wave choke 3-bank Yaxley switch; aerial panel; intervalve trans; locking clamps; lamp holder; 4 slow motion drives; valve caps; metal chassis and cover; no valves. Ideal for amplifier. Approx. contents not guaranteed. Post 1/6.

TYPE 25/1196 SUPERHET RECEIVER. 9/6. For s/wave receipt. ; these convert easily to A.C. Universal or Battery all-wave receivers. 465 IF's 4 tuning conds.; 28 fixed conds.; 39 resist. trans. ; switches, v/controls, v/holders, and all the usual parts, less valves. NOTE : we supply FREE mains drawings. Post 1/6.

T.V. PRE-AMPLIFIER. 6/6. Post 1/6. Requires 1 valve. EF54.

T.V. LENSES. For 8in., 9½in. or 10in., **50/-**. Or "Filter" type **55/-**.

ELECTRIC MOTOR BLOWER. 50/-. 1/3rd h.p. S/phase, A.C. 110 v. Can be converted to 230 volts. Complete with forge type blower, 3in. dia. outlet. Motor is 2,850—3,450 r.p.m., ½in. spindle. Carr. extra.

PANNIER BAGS. 15/6 each. Limited quantities. 1 pair per order. Made of tough, vulcanised, rubberised canvas. 14 x 10½ x 5½in. Water and dust tight, lined with ½in. sponge rubber. Require only fixing clips. Nothing else as good at twice the price. No P. Tax. Half post 1/-.

Money back guarantee. Cash with order please. Stamps ONLY for lists.

219 ILFORD LANE, ILFORD, ESSEX. *ILFord 0295*

AGENCIES

AN Australian representative of a large electrical and radio establishment will be visiting the United Kingdom from 9th April for several weeks and would be interested in discussing the possibilities of agency representation. —Communications should be sent to Mr. P. Holdsworth, c/o Bank of New South Wales, Berkeley Sq., London, W.1. [6732

TUITION

TELEVISION.

THE GOTHIC TELEVISION SCHOOL is the only school in Great Britain devoted solely to training in television; the school specializes in providing guaranteed home-study training for the R.T.E.B. Television Servicing Certificate and the Brit.I.R.E. Television examination; full details from—The Principal, Gothic Television School, 13, North Ave., London, W.13. [0051

THE COLLEGE OF AERONAUTICS, Cranfield.

TWO-YEAR course in Aircraft Electrical Engineering and Electronics.

APPLICATIONS are invited for admission to the above course which starts in October, 1951. The course, which leads to the Diploma of the College, provides a good grounding in aeronautical applications of electrical engineering, including electronics; subjects covered include the application of electronic techniques in measurement and control; airborne radio and radar devices; servomechanisms; aircraft electrical power systems; and aircraft serials; in the second year students have the opportunity to participate in research work to form the subject of a thesis.

APPLICANTS should have a University Degree or Higher National Certificate, with some previous knowledge of electrical engineering, but the College may, after interview, admit candidates without these qualifications who are of an equivalent educational standard.

FURTHER information and forms of application may be obtained from the Registrar, The College of Aeronautics, Cranfield, Bletchley, Bucks.

RADIO training—P.M.G. exams. and I.E.E. Dip.oma; prospectus free.—Technical College, Hull. [0111

WIRELESS operating; attendance and postal courses; stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7.

NOTHING succeeds like success! What we have done a thousand times we can do again, for you.—See the B.N.R.S. Advt. on this page. [0172

SEE the world, 600 Radio Officers required; send 2d stamp for prospectus to Britain's leading college; we train you in shortest period, at lowest cost.—Wireless College, Colwyn Bay.

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., on " no pass—no fee " terms; over 95% successes. For details of exams and courses in all branches of engineering, building, etc., write for 176-page handbook—free.—B.I.E.T. (Dept. 367B), 17, Stratford Place, London, W.1. [0118

NORWOOD Technical College, W. Norwood, London, S.E.27.—Full-time, part-time day and evening courses in radio and television (technology and servicing), radar and line; preparation for following examinations, C. & G. Full Technological, R.T.E.B., Amateur Transmitting Licence, P.M.G; free telecom. prospectus (A) from the secretary. (170). [6601

TELEVISION postal course for radio trades Examination Board's diploma; also postal courses for P.M.G. 2nd and 1st class Certificates and Amateur Radio Transmitting licence. —Apply British School of Telegraphy, Ltd., 179, Clapham Rd., London, S.W.9. (40 years' experience in coaching students in wireless telegraphy and allied subjects.) [0124

THE Institute of Practical Radio Engineers have available home study courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade; enroilments limited, fees moderate.—The Syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End, London, N.8. [0088

BOOKS, INSTRUCTIONS, ETC.

I.P.R.E. Technical Publications; 5,000 alignment peaks for superheterodynes, 4/9 post free; The Practical Radio Engineer, quarterly publication of the Institute, sample copy 2/- post free; membership and examination data 1/- post free.—Secretary, I.P.R.E., 20, Fairfield Rd., London N.8. [0089

Television Demonstration

of Sets and components every Friday 8-10 p.m.

TELEVISION CIRCUITS FOR THE CONSTRUCTOR

New Second Edition 1/6 post free.

HAYNES RADIO Ltd.

Manufacturers of the complete range of Television Receiving Equipment.

Queensway Enfield Middlesex

RADIO G200 OFFERS

CATHODE RAY INDICATOR UNIT

TYPE "97" complete with all valves and 6in. C.R. Tube. 6 EF50, 5 VR92, 4 VR54, EB34, 4505C, VCR517B.

A super bargain **52s. 6d.** Carriage 5s.

Trade and Overseas enquiries invited. Overseas Cables : "Hoilerad, Maidstone."

ARTHUR HOILE, *'Phone : 2812*
55, UNION ST., MAIDSTONE, KENT

THE BRITISH NATIONAL RADIO SCHOOL

ESTD. 1940

NOW IN OUR ELEVENTH YEAR AND STILL

NO B.N.R.S. STUDENT HAS EVER FAILED

to pass his examination(s) after completing our appropriate study course!

NOTHING SUCCEEDS LIKE SUCCESS

and what we have done a thousand times already, for others, we can do again, for YOU !

A.M.Brit.I.R.E. and CITY and GUILDS Radio and Telecommunications Exams., etc., etc.

Six months' trial period without obligation to continue.

Please mention this advt. and send for free booklet and sample lesson to:—

STUDIES DIRECTOR
BRITISH NATIONAL RADIO SCHOOL
66, ADDISCOMBE ROAD, CROYDON
Phone : Addiscombe 3341

"You can rely on us"

FOR CLEAN COMPONENTS AT COMPETITIVE PRICES

IMMEDIATE DISPATCH

MIDGET COIL-PACKS

These are an ideal miniature Coil-Pack especially suited where space is limited. They consist of iron-cored miniature coils for both Aerial and Oscillator stages, built-in Wavechange switch and midget trimmers. They are intended for an I.F. of 465 Kc/s. and I.F. Transformers type RS/GB 465 (12/6d. per pair) are the ideal companions for a trouble-free superhet.

TYPE "R"
MW/LW/GRAM. Ranges : 200-550 metres, 800-2,000 metres.
SIZE : Length 2¼in. Width 1¾in. Depth 1¾in.

TYPE "S"
MW/SW/GRAM. Ranges : 200-550 metres, 17-50 metres.
SIZE : As Type " R."

TYPE "C"
LW/MW/SW. Ranges : 800-2,000 metres, 200-250 metres, 17-50 metres.
SIZE : Length 3¼in. Width 1¾in. Depth 1¾in.

TYPE " R " and " S " each **25/-**. TYPE "C" each **28/6**. Post 6d.

All coils enclosed—all iron-dust cores adjustable. Completely wired, only five connections needed to external circuit.

Catalogue with Data, 3d.

RADIO SERVICING Co.

444, Wandsworth Road, London, S.W.8

Phone: MACaulay 4155.

77, 77A, Bus ; 2s. Tram. Wandsworth Rd. S.E. Station
Open till 6.30 p.m.

YOUR METER DAMAGED?

Leading Electrical Instrument Repairers to the Industry.

Repairs by skilled craftsmen to all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, Synchronous Clocks, etc. Quick deliveries—for speedy estimate send defective instrument by registered post to :—

L. GLASER
Electrical Instrument Repairers
341 CITY ROAD, E.C.1
Tel. Terminus 2489

"VIEWMASTER"
ENVELOPE, LONDON or MIDLAND 5/-
All specified components in stock.
75-80 Ω CO-AX. 1/2 per yard.
100k Midget Volume Controls 1/9
350v. 1 m/d. Metal Tubulars 6d.
TERMS: *C.W.O. only—Everything post paid. S.A.E. list.*
CARLOW RADIO
GREENFIELD, BEDFORD.

ELECTRONICS
DUPLEY
LTD.
CRANMER AV. EALING.W 13.
Transformer and Coil Manufacturers to the Trade
Telephone: EALing 5688

★
'Radiospares' Quality Parts
The Service Engineer's First Choice
★

ENGINEERS!

Whatever your age or experience, you *must* read "ENGINEERING OPPORTUNITIES". Full detail of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., CITY & GUILDS (Electrical, etc.), MATRIC., etc., on "NO PASS—NO FEE" terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto., Aero., Radio, etc., Building, etc. If you're earning less than £12 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE!

176 PAGES
Free!

B.I.E.T.
Dept. 387 Shakespeare Hse., 17-19 Stratford Place, London, W.1.
BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

"GLOBE-KING"
Short Wave Kits and Components. Production fully booked up until new series commence Autumn, 1951.
Watch this Magazine for later announcements.
JOHNSONS (Radio)
MACCLESFIELD

AUTOMATIC SWITCHES
(RECOaD.T.OaED)
ELECTRIC 1 to 100 AMPS. CLOCKWORK 7 to 35 DAYS
From **35/-** EACH
All guaranteed for a year.
Write for illustrated lists : **DONOHOE,**
2 UPPER NORFOLK ST., NORTH SHIELDS, NORTHUMBERLAND.

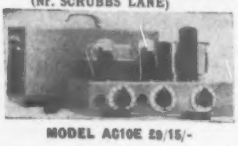
AMPLIFIERS *Quality* **KIT** *for* **HOME CONSTRUCTORS**
A complete set of components to construct a 10 watt amplifier including Woden potted mains transformer. 5 valves. 10 in. speaker with transformer. Components of the highest quality. No Govt. surplus. Three switched inputs, negative feed back, push-pull output, tone control, steel chassis. Suitable home or small hall. CASH WITH ORDER.
Price Complete to the last screw
£8 0 0
(Subject)
BEETHOVEN LTD
ELECTRIC EQUIPMENT
Chapel Lane, Sands, High Wycombe Tel : 1152/3

RADIOMENDERS LIMITED
FOR SPECIAL TRANSFORMERS AND REWINDS
We specialise in
AMATEURS' WINDINGS, TRANSFORMERS ALL TYPES, CHOKES, PICK-UP COILS, INSTRUMENT COILS, Etc.
Highest workmanship **Good Delivery**
★
RADIOMENDERS, LTD.
Television & Radio Apparatus, Transformer & Coilwinders.
123-5-7 Parchmore Road,
THORNTON HEATH, SURREY
LIV 2261. Trade enquiries invited. Established 16 years.

RELAYS AND KEY SWITCHES

LARGEST EX-GOVT. STOCK IN GT. BRITAIN
Types 600-3000 Relays — Siemens High Speed
Also A.C. 250 volts 50 cycles
Uniselector Switches, Telephone Switch-boards, Telephone Components, Plugs, Jacks, Handsets — **Government Contractors.**
JACK DAVIS (RELAYS) LTD. (Dept. W.)
36 PERCY STREET, LONDON, W.1
Phones : MUSeum 7960 LANgham 4821

PRATTS RADIO
1070 Harrow Road, London, N.W.10
(Nr. SCRUBBS LANE) **Tel. LADbroke 1734**



MODEL AC10E £9/15/-

AMPLIFIERS. College general purpose units. **MODEL AC10E,** 4 valve 10 watts. Neg. feedback. **£9/15/-. MODEL AC15E,** 6 valve, 15 watt P/P output. Feedback over 3 stages. **£14/14/-. MODEL AC32E,** 32 watts P/P output. Feedback over 3 stages. **£17/17/-. MODEL U10E,** for DC/AC mains, 6 valve 10 watt P/P output. Feedback over 3 stages. **£12/19/-.** All are complete with cases and chrome handles. They have a separate microphone stage. Separate inputs for mike and gram., allowing individual mixing etc. Outputs match 3, 8 or 15 ohm speakers. Max. input volts required for full stated output average Mike .003, Gram. .3 v. H.P. terms available. **MODEL AC20,** 5 valve P/P 8-10 watt unit for records, radio etc. Feedback over 3 stages. Output to 3, 8, 15 ohms. **£9/19/6. MODEL AC40,** 3 valve record/radio amplifier 4 watts to .3 ohms. **£5/5/-.** Ditto U4C for DC/AC mains. **£5/5/-.** Stamp for list. Full range of accessories available, including : Rothermel Crystal Mikes, **105/-**; Goodmans 12in. P.M. speaker, **£6/15/-**; Collaro A.C. Record Players, rim drive, magnetic model. **£9/9/-.** Crystal, **£6/15/-.** Jack plugs **1/6** each extra.
Nearest Station: Kensal Green.

SECTIONAL STEEL MASTS
Ex-Government Surplus Steel Tubing, made into Sectional Masts. Ideal for Television, Radio Flag Staffs, etc. Each Section approx. 2" dia. and 5' 6" long.
11ft. Mast (2 sections) **12/6d.** Carr. 2/6d.
22ft. Mast (4 sections) **22/6d.** Carr. 3/6d.
AT THESE PRICES THEY CANNOT LAST LONG
Send S.A.E. for our latest Clearance List of Radio and other Equipment.
WALTON'S WIRELESS STORES
203, STAVELEY RD., WOLVERHAMPTON

OUTSTANDING OFFERS FOR EXPORT ONLY

U.S.A. RADIO EQUIPMENT

RCA TRANSMITTERS Type ET-4331-H
Westinghouse AIRCRAFT TRANSMITTERS. Navy Model GO-9
TRANSMITTERS/RECEIVERS SCR-536
TEST EQUIPMENT IE-46
AN/TTQ-1 EQUIPMENT

U.S.A. RADAR EQUIPMENT

MK.26 (Models 3 and 4)
BM-Units
BN-Units
VF-Units
APS-3, 4 and 6 Units and Spares

RADIO AND RADAR SPARES (U.S.A.)

for most types of American Radio and Radar Transmitters and Receivers

AIRCRAFT INSTRUMENTS & ACCESSORIES (U.S.A.)

(Generators, Starters, Aviation Instruments)

Switchboards-Charging 1260w. No. 1

(several hundred)

Individual Test Certificates and A.I.D. Certificates can be supplied upon request.

ENQUIRIES TO

BRITISH SAROZAL LTD.

(Export Branch)

1, BRISTOL HOUSE, SOUTHAMPTON ROW, LONDON, W.C.1

Telephone : HOLborn 6763/4/5 *Cables : Sarozal, London*

OVERSEAS BUYERS ARE CORDIALLY INVITED TO VISIT OUR WAREHOUSES, SHOWROOMS AND LABORATORY

G2AK *This Month's Bargains* G2AK

C.R. TUBES Type 5CP1 brand new in cartons 17/6 each, plus 1/6 postage.

AR88D SPARE CRYSTALS. 455 Kc/s. 15/- each.

RECEIVERS. Type 18. Cover 6-9 Mc/s, and are for battery operation. New condition. Only 17/6 each. Phones to suit 4/6.

MOVING COIL HEADPHONES with moving coil microphone. Price 6/-. Post 1/-. Transformer to match 2/-. High resistance headphones, 4,000 ohms, 8/6 per pair. Post 1/-.

CABLE. 10ft. length flexible T.R.S. 3-core. Fitted with 3 position switch and plug. 1/6 post free.

TWIN RIBBON FEEDER. Heavy duty 300 ohm, 5d. per yd. Standard K25 300 ohm ribbon, 9d. per yd. Co-ax. cable, ¼in. dia. 70 ohm, 8d. per yd. ¼in. dia., 1/- per yd. 7ft. length ¼in. dia. Co-ax. with Pye plug one end, 1/6, post free. All other Co-ax. and feeder, plus 1/6 post any length.

POTENTIOMETERS. 5 watt wire-wound 20 k., 25 k., 2/-. 500 ohm and 2,000 ohm 50 watt wire-wound on heavy Ceramic former, 3/6 each. Carbon Type Potentiometers, 50 k., 100 k., 1 meg., 2 meg., 1/6.

BRAND NEW 807 VALVES. 10/- each or 4 for 35/-.

AERIAL INSULATORS. Pyrex 7in. ribbed glass, 3/6 per pair, plus 1/- post.

STATION LOG BOOKS. 200 pages printed one side only. Size 8½in. x 11in. First class paper and bound with heavy cover. Price 17/6.

Carriage paid on all orders over £1 except where stated. Please include small amount for orders under £1.

Please print your name and address.

CHAS. H. YOUNG, G2AK

All Callers to ***110 DALE END, BIRMINGHAM***

Phone : CENTRAL 1635

Mail Orders to ***102 HOLLOWAY HEAD, BIRMINGHAM***

Phone : MIDLAND 3254

RADIO DEALERS AND SERVICE ENGINEERS

WE HAVE WHAT YOU WANT

to service your Radio & Television Receivers. Stock Lines all Types of Condensers—Mains Transformers—Chokes—Coils—Potentiometers—Resistors—Loud Speakers, and many other attractive items at low prices.

SEND FOR OUR MONTHLY BULLETIN which includes special bargain lines.

— TRADE ONLY SUPPLIED —

HOME and OVERSEAS

V. E. S. WHOLESALE SERVICES LTD.

11, GUNNERSBURY LANE, WEST ACTON, W.3

'Phone : ACOrn 5027

LYONS RADIO Ltd.

VALVE GUIDE. Contains full data on more than 2,000 British and American valves and Television C.R. Tubes with base diagrams included. The latest and most modern work on valve data in this country. **PRICE 5/3,** post paid.

TELESCOPIC DINGHY AERIAL MASTS. Extend to 7ft. 3in. (2ft. when retracted). Max. dia. 1¼in. Min. ¾in. **PRICE 7/6,** post 1/-.

STROBE UNIT, TYPE 48. A radar unit containing a wealth of useful parts and valves, the principal components being : 6—VR91's, 1—VR116, 1—5Z4, 3-4 mfd. metal cased paper condensers, 600v. wkg., wire-wound and carbon pots., a 230 v. 15-30 mA. selenium rectifier, 2-relays one 2,000 the other 6,500 ohms, switches, H.F. chokes, pilot light holder, tag boards, etc. In brand new unused condition. **PRICE 52/6,** carriage 5/-.

MAINS TRANSFORMERS. Primary 200 to 250 v. 50 c.p.s. Secondaries : 350-0-350 v. at 80 mA., 4 v. at 5 a., or 6.3 v. at 4 a., and 4 v. or 5 v. at 2 a. For upright, sideways or as drop-thro. chassis mounting. Brand new and fully guaranteed. **PRICE 18/6,** post 1/6.

RECEIVER, TYPE R3547. Fitted with 15—VR91's, Pye 45 M/c. strip, relays, 24 v. motor, hundreds of other useful components, including 8 other valves. In good condition. **PRICE £5/10/-** carriage 6/6.

3, GOLDHAWK RD. (Dept. M.W.), SHEPHERDS BUSH, LONDON, W.12

Telephone : SHEpherds Bush 1729

HOME and OVERSEAS

RADIO DEALERS & SERVICE ENGINEERS

Write for our 1951 Wholesale Price List, giving details of A. W. F. Loudspeaker cone assemblies, for fast, economical repairs in your own workshops. A. W. F. Range of Transformers for nearly all replacements. T. C. C. Capacitors, Tungsram Valves, Erie Resistors & Potentiometers. "View Master" & "Electronic Engineering" Televisor Components & Cabinets. Brass B. A. Screws, etc., and hundreds of other lines. **Postage 3d.** Inland. 2/- Overseas Air Mail.

A. W. F. RADIO PRODUCTS

TATLER CHAMBERS THORNTON ROAD

BRADFORD · YORKS.

CONDENSERS	Silver Mica · Tubular · Mansbridge
CRYSTALS	American · British
HEADPHONES	High and Low Impedance
METERS	Thermo · Moving Coil · Moving Iron
PLUG & SOCKETS	All Types
RESISTORS	Carbon and wire wound
VOLUME CONTROLS	Carbon and wire wound

We hold large and comprehensive stocks of new components and units, both Government and Manufacturers' Surplus

No. 19 Set, Equipment Available.

Wholesale and Export Only.

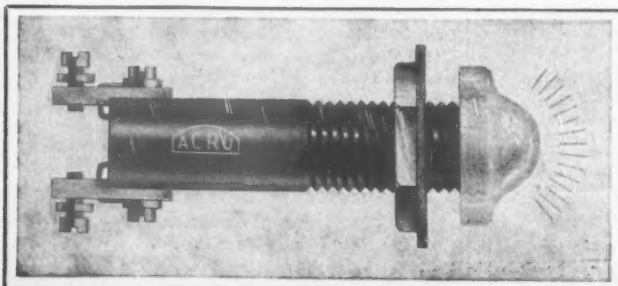
ANDERS RADIO LTD.

167, HAMPSTEAD ROAD, LONDON, N.W.1

EUS. : 1639 EST. 1928

INDEX TO ADVERTISERS

	PAGE
A.A. Tools	103
Acoustical Mfg. Co., Ltd.	31
Acru Electric Tool Mfg. Co., Ltd., The	110
Adcola Products, Ltd.	50
Aerialite, Ltd.	18
Allan, Richard, Radio, Ltd.	22
Ambassador Radio	94
Anders Radio, Ltd.	109
Antiference, Ltd.	14
Armstrong Wireless & Television Co., Ltd.	97
Arrow Sales, Inc.	103
Ashworth, H.	51
Audigraph, Ltd.	98
Audix, B. S., Ltd.	10
Automatic Coil Winder & Electrical Equipt. Co., Ltd., The	1
A.W.P. Radio Products	109
B. & H. Radio	102
Bakers "Selhurst" Radio	14
Baldwin Instrument Co., Ltd.	34
Barker, A. C.	97
Beethoven, Ltd.	103
Belling & Lee, Ltd.	61
Berry's (Short Wave), Ltd.	22
Birmingham Sound Reproducers, Ltd.	24, 56
Bradmatic, Ltd.	42
Brierley, J. H. (Gramophone & Recordings), Ltd.	48
Britain, Chas. (Radio), Ltd.	86
British Communications Corpn., Ltd.	46
British Institute of Engineering Technology	102, 108
British Insulated Callender's Cables, Ltd.	Cover ii
British National Radio School	107
British Physical Laboratories	54, 87
"British Plastics" Exhibition	40
British Rola	39
British Savozal, Ltd.	109
Brookes Crystals, Ltd.	105
Brown, S. O., Ltd.	18
Buchan, A. E.	94
Bulgin, A. F., & Co., Ltd.	52, Edit. 207
Bull, J., & Sons	95
Bullers, Ltd.	4
Cabot Radio Co., Ltd.	99
Candler System Co.	105
Carlow Radio	103
Champion Products	92
Chancery Precision Instrument Service, Ltd.	45
Chapman, C. T. (Reproducers), Ltd.	54
Charles Amplifiers, Ltd.	6
Cinema-Television, Ltd.	37
Clydesdale Supply Co., Ltd.	81
Cohen, D.	68
Cosmocord, Ltd.	60
Cossor, A. C., Ltd.	33
Coulphone Radio	107
Coventry Radio	98
Davis, Alec, Supplies, Ltd.	83
Davis, Jack (Relays), Ltd.	108
Day Will, Ltd.	102
Donohoe, J.	103
Drayton Regulator & Instrument Co., Ltd.	44
Dubilier Condenser Co. (1925), Ltd.	17
Duke & Co.	107
Dun Electronics	102
Dupley Electronics, Ltd.	108
Edison Swan Electric Co., Ltd.	29
Electradix Radios	102
Electro Acoustic Developments	58
Electro Technical Assemblies	44
Electronic Instruments, Ltd.	50
Electronic Precision Equipment	74, 75
Electronic Service (Hallamshire), Ltd.	6
E.M.G. Handmade Gramophones Ltd.	96
E.M.I. Institutes	30
E.M.I. Sales & Service, Ltd.	66
Erskine Laboratories, Ltd.	4
Eta Tool Co. (Leicester), Ltd.	22
Fluxite, Ltd.	98
Frith Radiocraft, Ltd.	16
Furzehill Laboratories, Ltd.	52
Galpins	95
Gardners Radio, Ltd.	48
Garrard Bros.	76
General Electric Co., Ltd.	27
Glaser, L.	108
Goodmans Industries, Ltd.	41
Goodsell, Ltd.	2
Gramp.an Reproducers, Ltd.	28
Gray, Arthur, Ltd.	32
Guild of Radio Service Engineers	90
Hall Electric, Ltd.	8
Hallam, Sleigh & Cheston, Ltd.	40
Hartley, H. A., Co., Ltd.	92
Hatfield Instruments	28
Hayes Co., The	100
Haynes Radio, Ltd.	107
Hazlehurst Designs, Ltd.	36
Henley's, W. T., Telegraph Works Co., Ltd.	106
Henry's	88
Hivac, Ltd.	43
Houle, Arthur	107
Holley's Radio Stores	94
Homelab Instruments	16
H.P. Radio Services, Ltd.	85
Hunt, A. H., Ltd.	12
Imhof, Alfred, Ltd.	8
Industrial Electronics	41
International Correspondence School, Ltd.	20
Jackson Bros. (London), Ltd.	47
"J.B." Service, The	103
Johnsons (Radio)	108
Juneero, Ltd.	16
Lasky's Radio	82, 83
Lawrence, G., & Co.	86
Leak, H. J., & Co., Ltd.	67
Lewis Radio Co.	100
Lockwood & Co.	100
London Central Radio Stores	35
London Radio Supply Co.	47
Lowe Bros.	101
Lowther Mfg. Co.	42
Lyons, Claude, Ltd.	90
Lyons Radio	109
Mail Order Supply Co.	77
Marconi Instruments, Ltd.	31
Marconi's Wireless Telegraph Co., Ltd.	53, 64
McCarthy Radio	89
McElroy-Adams Mfg. Group, Ltd.	90
McMurdo Instruments Co., Ltd.	30, 69
Measuring Instruments (Pullin), Ltd.	48
Metro Pex, Ltd.	51
Metropolitan-Vickers Electrical Co., Ltd.	25
Midland Instrument Co.	88
Miers, N., & Co., Ltd.	14
Modern Book Co.	96, 101
Modern Electrics, Ltd.	105
M.R. Supplies, Ltd.	16
Mullard, Ltd.	3, 58
Multicore Solders, Ltd.	Cover iv
Mycalex, Ltd.	88
New Electronic Supplies Co.	98
New London Electron Works, Ltd., The	85
Newman, J. & S., Ltd.	34
Northern Radio Services	103
Northern Transformers Co.	104
N.S.F., Ltd.	7
Nusound Products	105
Oliver Pell Control, Ltd.	36
Olympic Radio Components	54
Osmor Radio Products, Ltd.	34
Painton & Co., Ltd.	50
Park Radio, Ltd.	20
Parmeko, Ltd.	55
Partridge Transformers, Ltd.	91
P.C.A. Radio	88
Pearce, T. W.	91
Pearson, M. & J.	100
Pennine Amplifiers	96
Pitman, Sir Isaac, & Sons, Ltd.	101
Plessey Co., Ltd.	23
Post Radio Supplies	104
Pratts Radio	108
Premier Radio Co.	69, 70, 71, 72, 73
Quality Mart	94
Quartz Crystal Co., Ltd.	106
Radio Exchange Co.	93
Radio Merchandise Co., Ltd.	99
Radio Servicing Co.	107
Rado Supply Co.	64
Radiomenders, Ltd.	108
Radiospares, Ltd.	108
Rainbow Radio Mfg. Co., Ltd.	52
Redifon, Ltd.	38
Reliance Mfg. Co. (Southwark), Ltd.	104
Reproducers & Amplifiers, Ltd.	26
Robinson, F. C., & Partners, Ltd.	45
Roding Laboratories	32
Rogers Development Co.	46
Rollet, H., & Co., Ltd.	106
Royal Air Force, The	19
Runbaken Electrical Products	106
Salford Electrical Instruments, Ltd.	53
Samsons Surplus Stores	106
Sangamo Weston, Ltd.	65
Savage Transformers, Ltd.	94
Scharf, Erwin	46
Sifam Electrical Instrument Co., Ltd.	58
Simon Sound Service	39
Smith, H. L., & Co., Ltd.	100
Smith, G. W. (Radio), Ltd.	93
Sound Sales, Ltd.	64
Southern Radio Supply, Ltd.	96
Spencer West	102
Sphere Radio, Ltd.	30
Stability Radio Components, Ltd.	24
Standard Telephones & Cables, Ltd.	13, 59, 62
Steatite & Porcelain Products, Ltd.	9
Stern Radio, Ltd.	80
Sugden, A. R., & Co. (Engineers), Ltd.	12
Supacoils	101
Szymanski, S.	26
Taylor Electrical Instruments, Ltd.	11
Taylor, Tunnicliff (Refractories), Ltd.	15
Telecraft, Ltd.	55, 104
Telegraph Condenser Co., Ltd.	Cover iii
Telegraph Construction & Maintenance Co., Ltd., The	56
Tele-Radio (1943), Ltd.	38
Thermionic Products, Ltd.	52
Transradio, Ltd.	26
Trix Electrical Co., Ltd.	Edit. 205
Ultra Electric, Ltd.	10
United Insulator Co., Ltd.	54
Universal Electrical Instruments Corpn.	78
University Radio, Ltd.	79
Validus Aerials	99
Valradio, Ltd.	40
V.E.S. Wholesale Services, Ltd.	109
Vitavox, Ltd.	49
Voigt Patents, Ltd.	100
Vortexion, Ltd.	63
Walton's Wireless Stores	108
Wayne Kerr Laboratories, Ltd., The	42
Westinghouse Brake & Signal Co., Ltd.	6
Weymouth Radio Mfg. Co., Ltd., The	20
Wharfedale Wireless Works	45
Whiteley Electrical Radio Co., Ltd.	66
Wilco Electronics	98
Wilkinson, L.	104
Wireless Telegraph College	52
Woden Transformer Co., Ltd.	34
Wright & Weaire, Ltd.	5
Young, C. H.	109



ACRU-NEON INDICATOR LAMPS

are now available for EVERY PURPOSE

12 new models from ¼" DIA. Dome to 1¼" DIA. for all voltages from 60 to 500 A.C. or D.C.

ASK FOR NEW LEAFLETS

THE ACRU ELECTRIC TOOL MFG. CO. LTD. 123, Hyde Road, Ardwick, Manchester, 12

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford St., London, S.E.1, by CORNWALL PRESS LTD., Park Garden, London, S.E.1. *Wireless World* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd., William Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co.

Condenser leadership -from the inside!

Terminal hermetically sealed: two pronged soldering tag.

Robust bakelite case: maximum path between terminals to avoid possible flash-over.

Series wound element: conservatively rated to provide ample safety margin.

"Visconol" impregnation and filling for safe H.V. working; prevents arcing or brushing.

Hermetic sealing on to special gasket avoids reliance on soldered joints.

Sturdy one-hole fixing.

Suitable for use in conditions of tropical humidity.

The unique design of these chassis-mounting Condensers renders them eminently suitable for television and allied high voltage applications up to 50,000 v. where exceptionally stringent conditions are likely to be encountered. They are processed with the newly developed impregnant "Visconol", which affords the advantages of adequate voltage rating and low power factor, whilst improving the stability of the dielectric and its power to withstand sharp-front short-time surges. Wide range of working temperature -40°C. to +71°C., ensures reliable operation under most stringent conditions.

TCC

'VISCONOL' CATHODRAY CONDENSERS

THE TELEGRAPH CONDENSER CO. LTD · *RADIO DIVISION* · LONDON · W.3 · Tel: Acorn 0061 (9 lines)

THE FINEST CORED SOLDER IN THE WORLD

SPECIFIED ALL OVER THE WORLD BY LEADING MANUFACTURERS OF RADIO & TELEVISION EQUIPMENT

DuMont Factory, Newark, U.S.A.

Canadian Admiral Corporation, Malton, Ontario.

Philips Argentina S.A. Saavedra, Buenos Aires

It is impossible for us to show illustrations of all the manufacturers who use Ersin Multicore Solder. We apologise to those who are not included in this advertisement.

Bang & Olufsen, Struer, Denmark.

Luxor Radio Factory, Motala, Sweden.

Tandberg Radiofabrikk, Oslo, Norway.

H. Karayannis & Co., Athens, Greece.

Philips Radio Factory, Calcutta, India.

Invictus Radio Works, Brazil.

Amalgamated Wireless Ltd., Sydney, Australia.

Collier & Beale, Wellington, New Zealand.

FOR THESE EIGHT GOOD REASONS

● The 3-cored construction guarantees flux continuity and prevents "dry" or H.R. joints.

● Multiple core composition means thinner walls of solder, which result in instant melting.

● The correct proportion of flux to solder is always assured - no extra flux is required.

● Soldered joints made with Ersin Multicore remain free from corrosion even after prolonged exposure.

● The flux residue is impervious to moisture, hard, non-sticky, non-toxic, and avoids accumulation of dirt.

● For more than a decade the same unvarying and consistently high quality.

● Ersin Flux reduces surface tension of molten solder, causing it to wet metals rapidly. It also cleans oxidised metallic surfaces.

● Fully approved by A.I.D. and G.P.O. and complies with U.S. Govt. specification B.S.S. 219 & 441 and M.A.P., D.T.D. 599.

ERSIN Multicore THREE CORE SOLDER WIRE

SIZE 1 CARTONS 5/- RETAIL.

Catalogue Ref. No.	Alloy Tin/Lead	S.W.G.	Approx. Length per Carton
C.16014	60/40	14	13 feet
C.16018	60/40	18	37 feet
C.14013	40/60	13	13 feet
C.14016	40/60	16	26 feet

MULTICORE SOLDERS LTD., MELLIER HOUSE, ALBEMARLE STREET, LONDON, W.1 • REGent 1411